

Indiana



Wellhead

Protection

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WELLHEAD PROTECTION:
A PROGRAM FOR THE STATE OF INDIANA

I. INTRODUCTION

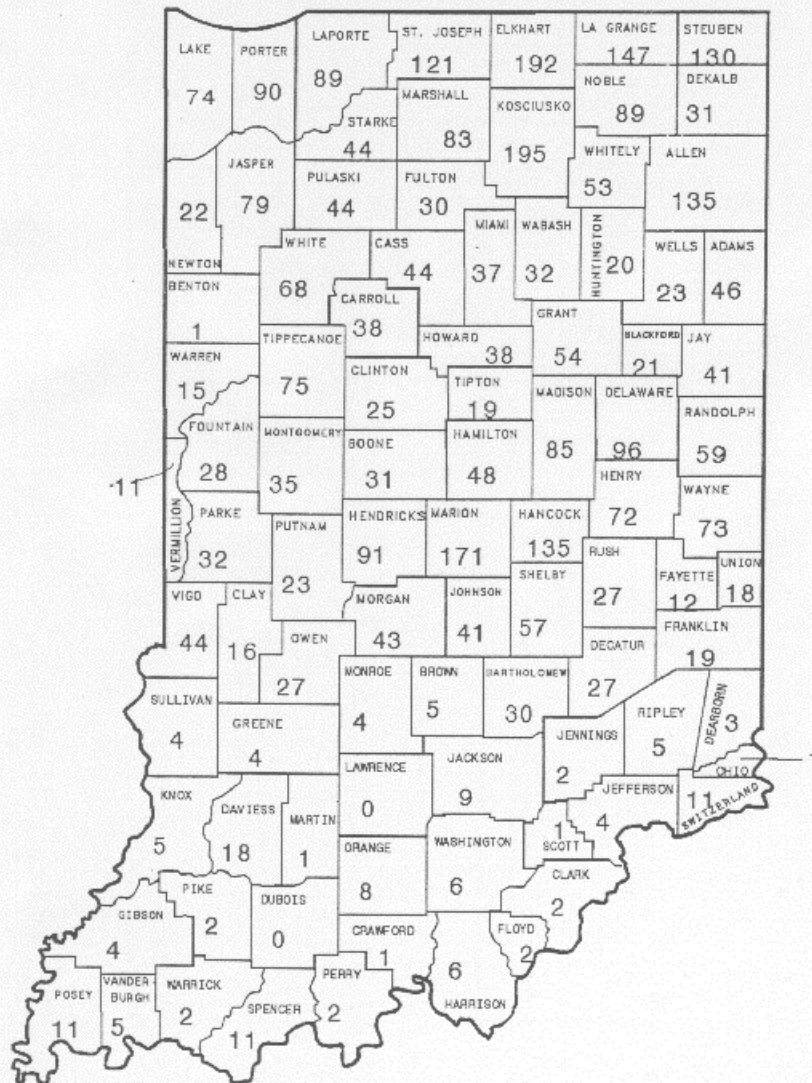
Ground water supplies approximately 60% of Indiana's public drinking water. In addition, ground water is considered the primary resource to supply future drinking water needs in order to support the State's growing population. To provide for a safe supply of drinking water, the State of Indiana is undertaking a Wellhead Protection Program (WHPP) to protect ground water resources used for drinking water purposes. Requirements for drinking water quality placed on public water supply systems (PWSSs) by the federal Safe Drinking Water Act (SDWA) are difficult to adhere to with monitoring and treatment alone. Based on this, they advance prevention as a means to help PWSSs achieve drinking water standards on a consistent basis. Prevention of contamination is acknowledged as an efficient and effective means, both economically and technically, of maintaining safe drinking water for the citizens of Indiana.

Presently, there are approximately 4,500 PWSSs operating in Indiana that derive their supply from ground water. Community public water supply systems (CPWSS) account for roughly 900 of the total number of public water supplies (*Figure 1*). A CPWSS is defined by the federal Safe Drinking Water Act as a system which possesses at least 15 service connections or supplies water to at least 25 people on a continual basis. The remaining number of systems consists of transient and non-transient non-community water supplies (*Figure 2*).

Historically, the State of Indiana has considered public water supplies as a high priority for protection. Since the 1930's, Indiana has instituted an informal policy requiring a 200 foot minimum separation distance between a public water supply system (PWSS) well or well field and sources of bacteriological contamination (e.g., sanitary sewers). Presently, a well site approval for new wells and well fields is issued by the Department of Environmental Management (IDEM) as a condition of acquiring a well construction permit. The well site approval process includes an assessment of land use within a 3,000 foot radius of the proposed well or well field to consider other potential sources of contamination, such as chemical pollutants.

In addition to the well site survey process, Indiana's solid waste rule requires proposed solid waste landfills to be located at least 3,000 feet from a PWSS well. Other minimum siting requirements are incorporated into State source control programs, such as on-site sewage disposal systems. While these procedures provide measures of protection, the Wellhead Protection Program is a more progressive approach to protecting public water supplies from contamination, which considers not only the location of the well, but the surface area above the subsurface zone contributing water to the well under pumping conditions.

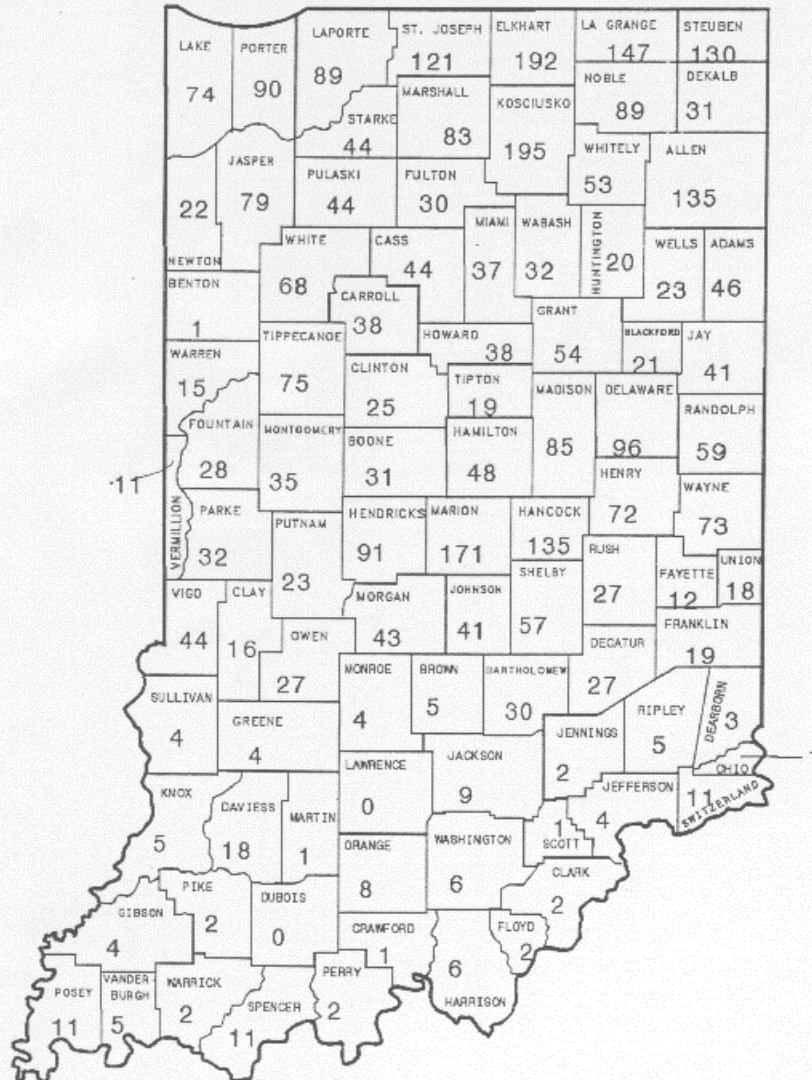
Figure 2
Non-Community Water Systems
Served by Ground Water



Source: IDEM Drinking Water Branch

Figure 1.

Figure 2
Non-Community Water Systems
Served by Ground Water



Source: IDEM Drinking Water Branch

Figure 2.

A. Statutory and Policy Basis

The 1986 Amendments to the federal Safe Drinking Water Act require States to formally protect ground water that supplies public water systems. Section 1428 of the SDWA requires States to develop plans that describe the following elements:

1. Duties of State and local agencies and PWSSs in implementing the program;
2. Determination of wellhead protection areas (WHPAs) for each public well or well field;
3. Identification of all potential anthropogenic sources within the protection area;
4. A program that contains, as appropriate, technical assistance, financial assistance, implementation of control measures, education, training, and demonstration projects to protect wellhead areas from contaminants;
5. Contingency plans for alternative water supplies in case of contamination;
6. Siting consideration for all new wells; and
7. Public participation.

Authority for approval of State programs was provided to the Administrator of the U.S. Environmental Protection Agency (EPA). To assist States in the development of WHPPs, guidance describing the various components of a State's program has been developed by EPA.

In response to the requirements of Section 1428 of the federal SDWA, the State of Indiana identified wellhead protection as a priority in the Ground Water Quality Protection and Management Strategy developed in 1987. To formalize Indiana's commitment to the protection of public water supplies, the 1989 Ground Water Protection Act [IC 13-18-17-6] authorized the Water Pollution Control Board to establish regulations to protect community PWSS well fields from contamination [IC 13-7-26-7].

To support the policy advanced in the 1987 Strategy, the provisions of the 1989 GWPA, and the requirements of the federal SDWA, Indiana has developed a program that describes the State's policy toward preventing contamination within the area contributing water to a PWSS well. Prevention is addressed through activities performed by State, federal, and local government and action by a PWSS.

Indiana's approach to Wellhead Protection (WHP) consists of a mandatory component for the development of local programs for CPWSSs. In this, community systems will be required to meet the minimum elements of community planning, delineation, source identification, management of potential sources, and contingency planning. The specific requirements under

each element are described throughout the remainder of this document. In addition to the mandatory approach for community systems, non-community PWSSs are encouraged to develop WHPPs through voluntary participation. Where non-community systems develop WHP plans, the State will endorse the program where a non-community system's plan is consistent with the requirements of a community system.

B. Program Overview

The purpose of this document is to describe the State's approach to protect public water supplies from contamination under the various elements prescribed by the federal SDWA. Because Indiana's approach consists of actual implementation at the local or system level, it is imperative for the program to provide an overview describing the steps necessary for systems to initiate, develop, and ultimately implement a WHP plan. In addition, the various activities the State will pursue to provide a consistent and effective level of protection of public water supplies must be outlined.

In understanding the difference between development and implementation, Indiana recognizes an effective program may not be able to evolve in a relatively short period of time. To provide for this, Indiana's program will support a phased process for implementation of the management measures a PWSS intends to undertake to minimize the potential for contamination from a specific source.

Therefore, Phase I of the Indiana WHPP comprises the basic elements of community planning, delineation, source inventory, and contingency planning for contamination events (*Table I.1*). In addition to these basic elements, a community water supply must describe the management measures it intends to undertake for all potential sources identified in its WHPA. In Phase II, a community system must document how the proposed management measures have been or are being implemented. An adequate period of time is allocated for implementation, where smaller systems are allowed a longer implementation period than larger systems (*Table I.1*).

TABLE I.1 - WELLHEAD PROTECTION OVERVIEW

	Public Water Supply System Size (population served)	Number of PWSS	PHASE I		PHASE II			
			Time to Submittal from rule enactment (years)	Submittal Requirements	Time frame for Phase II submittal, after Phase I approval (years)	Update and Approval Requirements		
MANDATED	Community PWS		<div>1. Names, roles, and affiliation of the local planning team members.</div> <div>2. WHPA delineation, including:<div>A. Summary of geologic and hydrologic condition of the WHPA.</div><div>B. Model input data.</div><div>C. Justification of model choice.</div></div> <div>3. Potential pollution source inventory.</div> <div>4. Management strategy with time-table for implementation.</div> <div>5. Contingency plan.</div> <div>6. Description of public participation.</div> <div>7. Description of public education program.</div>		<div>1. Comprehensive WHPP.</div> <div>2. Updated schedule of implementation plan.</div> <div>3. Updated WHPA, if necessary.</div> <div>4. Update of source identification list.</div> <div>5. Report of any problems or concerns re: WHPP.</div> <div>6. Contingency Plan revisions (if needed).</div> <div>7. Documentation to confirm:<div>A. Area 1 meets requirements.</div><div>B. Abandoned wells are identified.</div><div>C. Wellhead is secure.</div><div>D. All potential sources of contamination, within the WHPA, are managed.</div><div>E. Signs posted at WHP perimeter.</div><div>F. Public education on-going.</div><div>G. Report new ground water contamination in the WHPA.</div></div>			
	Large >50,000	12					3	5

	Public Water Supply System Size (population served)	Number of PWSS	PHASE I		PHASE II	
			Time to Submittal from rule enactment (years)	Submittal Requirements	Time frame for Phase II submittal, after Phase I approval (years)	Update and Approval Requirements
	Medium 3,300 to 50,000	16 6	4		7	
	Small <3,300	71 7	5		10	
	Total	89 5	3-5	5-10		
VOLUNTARY	Non-Community PWS					
	Non-Transient	61 0	N/A	10 years following Phase I Submittal		
	Transient	31 69	N/A			
	GRAND TOTAL	46 74	3-5	8-15		

1. Local Planning Team

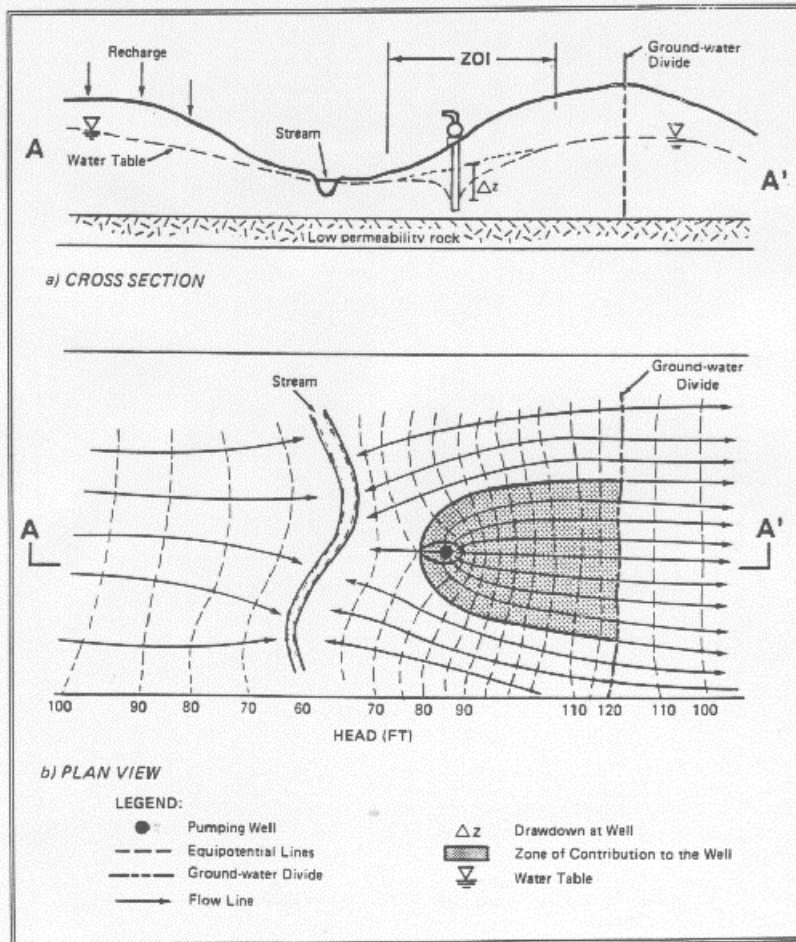
The initial step required to develop a WHP plan is the organization of the appropriate people to plan the system's or community's approach to WHP. A local planning team (LPT) must be organized to provide support to decisions relevant to the various aspects of a local WHP plan. It is recommended that appropriate representatives from all perspectives of wellhead protection be a part of the local planning team. It is mandated that a minimum of one (1) person that may be affected by the development and implementation of the WHP be a member of the LPT.

The local planning team should guide the process for delineation of the WHPA, identification of potential sources of contamination, the determination of specific management measures to be implemented, and the development of a contingency plan to provide for emergencies resulting from contamination events.

2. WHPA Delineation

Deciding how to delineate the WHPA is an initial activity of the local planning team. The purpose for delineation is to appropriately determine the area for implementing activities to protect the water supply from contamination. The methods for delineation recognize the system's need to accurately define the area contributing water to the well or well field (*Figure 3*). Numerous decisions are intrinsic to the delineation process, the incorporation of future water supply needs, the hydrogeologic data needed to adequately support the delineation, etc. The minimum requirements for delineation, including the information necessary to justify the method selected, are provided in the Delineation section of this document (Section III). Guidance for systems in the selection of an appropriate delineation method will be developed by the IDEM.

Figure 3 - Cross section and plan view of how a pumping well effects the (potentiometric surface) - water table and streamlines flow to a well.
Source: E.P.A. (1987)



I-8

Figure 3

I-9

3. Source Identification

Following the delineation step, the system should undertake a program for identifying all potential sources of contamination located within the delineated WHPA. A source inventory (source I.D.) should consist of the information necessary to manage the potential source to prevent contamination. This information should include: a map locating the identified sources, the type of activity performed at the site, chemicals stored or handled on-site, and whether the facility is regulated by local, State, or federal agencies. Several methods for undertaking a source inventory are described in the Source Identification section of this document (Section IV).

4. Management Strategy

Following the delineation and potential source inventory steps, the system should determine appropriate measures to manage all potential sources within the WHPA. A plan, with corresponding schedule for implementation, should be developed by the system, or, more appropriately, the local planning team. Requirements for potential source management are described in the Management section of this document (Section V).

5. Contingency Plan

In addition to the above steps, the system must develop a plan to provide for contingencies when there is an emergency resulting in contamination to the well or within the delineated WHPA. This plan generally consists of a list of emergency phone numbers, agreement with local or State emergency response programs to contact the PWSS in case of contamination events, and procedures to follow when contamination occurs. A plan for providing alternative sources of water should also be developed. This program provides the necessary elements of a WHP contingency plan in Section VI of this document. Additionally, the IDEM will develop guidance for developing a comprehensive contingency plan that considers all emergencies that may be encountered by a PWSS.

6. New Wells

To insure new wells and well fields are properly sited, the concepts of wellhead protection should be incorporated into the design phase of a well field. To support this philosophy, the State of Indiana will revise its construction permitting procedures to include preliminary delineation (e.g., 3,000 foot radius) and source identification before the well site is approved. The well site approval procedures have been incorporated into the WHP regulations as a requirement for all new well

site development. Specifics on the new well construction permit procedures can be found in Section VII of this document.

C. WHPP Submittal

1. Phase I

The CPWSS must submit a WHP plan describing the system's delineation, source inventory, strategy for management of potential sources of contamination, and contingency plan to the Indiana Department of Environmental Management (IDEM), Drinking Water Branch for review. A Phase I WHP plan will constitute an application to the IDEM for approval of the system's plan for wellhead protection. The IDEM review of a PWSS's proposed plan for wellhead protection will be based on determining the appropriateness of the delineation, the comprehensiveness of the source inventory (primarily whether the source inventory provides the information necessary to support management decisions), the adequacy of the management plan to protect the well or well field from contamination, and the comprehensiveness of the contingency plan. The IDEM's review will also insure compliance of the system's plan with the minimum requirements listed in this document and the State's WHP regulation (327 IAC 8- 4.1).

In addition to a formal review of the adequacy of the system's plan, the IDEM will initiate a site visit to observe the characteristics of the WHPA, and obtain accurate locational information on the well or well field through the use of global positioning system (GPS) equipment. An accurate location of the well or well field will provide a greater degree of protection by allowing the various State source control or remedial programs to recognize public water supplies with respect to siting facilities or developing effective remediation plans.

After review, PWSSs which demonstrate an adequate WHP plan will be awarded a formal plan approval by the IDEM. Approval of local WHP plans will be contingent on the system's commitment to implementing the management measures outlined in the management plan.

The Phase I Submittal package will consist of the following (specific criteria for each portion of the submittal are provided in the remaining portions of this document):

- a. Application form for Phase I (currently under development by the IDEM);
- b. A brief background of the public water supply system, the community serviced, including a discussion of the local planning

team, any specific committees and their duties, and the team/committee membership;

- c. A map of the delineated wellhead protection area (WHPA) -- to a scale between 1"= 400' and 1"= 1,000' -- and a summary report detailing the geologic and hydrogeologic conditions of the area and supporting data for the delineation (for systems not using fixed radius);
- d. A source inventory, in tabular form, that describes the nature, location, and status of potential sources of contamination existing within the delineated WHPA. An accompanying map, which must reference the tabular inventory, is required. This source inventory map may be the same as the delineation map, as long as all identified sources are plotted on this map;
- e. A strategy for management of all potential sources identified, which includes a schedule for implementation of the proposed potential source management measures;
- f. A contingency plan for contamination within the delineated WHPA;
- g. A summary of the efforts of the PWSS and/or local planning team to involve public participation in decisions for wellhead protection; and
- h. A summary of the public education/outreach program instituted by the PWSS, community, and/or local planning team.

These components comprise an application to the Commissioner of the IDEM for approval of the system's Phase I Wellhead Protection Plan. All components outlined must be submitted with the Phase I application, or the application will be rejected on the basis of incompleteness. The IDEM will approve or disapprove of the material submitted within one-hundred and eighty (180) days from submission.

2. Phase II

Following approval of a Phase I WHP plan, CPWSSs will be required to initiate the management of potential sources according to the schedule proposed in the management plan. Approval of a Phase II WHPP will be awarded by the IDEM when the system has demonstrated management of all potential sources as proposed in the management plan. This demonstration will be documented in an application for approval of Phase II. However, a Phase II approval does not indicate the conclusion of wellhead protection; continual implementation of the management

measures must be maintained. The time frame for the Phase II submittal will start after the Phase I WHP plan is approved.

To encourage continual implementation of potential source of contamination management within a WHPA, the IDEM will institute a regular status reporting mechanism to identify problems and determine where assistance is needed. On a five-year basis, all systems developing or implementing WHP plans (including non-community systems voluntarily participating in the program) will be required to submit a succinct report on the status of the development or implementation of their local WHP plan.

The Phase II submittal package consists of the following components:

- a. Application form for Phase II approval (currently under development by IDEM);
- b. A discussion of updates to the approved Phase I Wellhead Protection Plan, such as the following:
 - The background of the PWSS, community, and local planning team;
 - An updated WHPA delineation, if performed due to consideration of new data;
 - An updated source inventory, including a revised table and map showing the present status of existing or new potential sources within the delineated WHPA; and
 - A revised contingency plan, if changed since the Phase I approval, and documentation of training given to local responders.
- c. Documentation of the implemented management strategy, which exhibits the following:
 - The sanitary setback area meets requirements;
 - All abandoned wells not in compliance with I C 25-39-4-6, are identified;
 - The wellhead is secure;
 - All potential sources identified are properly managed -- through the measures proposed in the approved Phase I management strategy;
 - Signs are posted at the WHPA perimeter on major thoroughfares;
 - An ongoing public education and outreach program exists;

- and
- New or existing ground water contamination in the WHPA is reported.

These components comprise an application to the Commissioner of the IDEM for approval of the system's Phase II Wellhead Protection Program. All components described above must be submitted with the Phase II application, or the application will be rejected on the basis of incompleteness. The IDEM will approve or disapprove the materials submitted within one hundred eighty (180) days after submission.

3. Submittal Time Frames

The time-frame for submittal of both the Phase I and Phase II applications are provided in *Table I.1*. The time period identified for each system type are in years from the effective date of the WHP rule (327 IAC 8-4.1-16). The following provides a narrative of the submittal schedule:

- a. Phase I submittals are as follows:
 - All materials must be submitted within three (3) years for large CPWSS; (> 50,000) population served;
 - All materials must be submitted within four (4) years for medium CPWSS; (3,301 to 50,000) population served;
 - All materials must be submitted within five (5) years for small CPWSS. (<3,300) population served.
- b. Phase II submittals are as follows:
 - All materials must be submitted within five (5) years after department approval of Phase I material for large CPWSS;
 - All materials must be submitted within seven (7) years after department approval of Phase I material for medium CPWSS;
 - All materials must be submitted within ten (10) years after department approval of Phase I material for small CPWSS.

The department will provide written approval or denial of the PWSS's submittal within one-hundred eighty (180) days from submission.

D. State Role

The State's efforts in WHP will not be limited to approval of new wells, coordination of regulatory source information, and review of local wellhead protection plans. The role of the State is to provide a consistent and effective level of source control and management. Current source control regulations implemented by State and local government generally provide minimum setback distances for sources from PWSS wells. However, many of these setback distances are inconsistent. The intention of the State is to work within the current and proposed regulatory framework to coordinate the requirements of the WHPP and the management criteria imposed by source control regulations.

To affect this coordination, the IDEM, Drinking Water Branch will work with all State source control and management programs during rule development and revision efforts to integrate the management concepts of the WHPP into the source control rule framework. Integration of source control regulations with the WHPP will assist PWSSs in the implementation of their management plan. In effect, the management of State and federally regulated potential sources of contamination will be implemented by the relevant regulatory agency, thereby reducing the entire burden for source management of the PWSS. In addition, the IDEM will work with all existing State and federal source control programs to track permits and other site-related information to provide PWSSs with accurate information on the location of regulated facilities within WHPAs.

To further assist PWSSs in the development of local programs, the IDEM-Drinking Water Branch will undertake an aggressive public education and outreach program. Workshops on WHP concepts such as delineation, source inventory procedures, and management of potential sources will be offered by the IDEM. Assistance to PWSSs will be precipitated, in part, through the status reporting process. Specifically, a standard reporting format will be developed which will provide the IDEM insight to the issues encountered by PWSSs in the development and implementation of local plans. The IDEM will be tracking the implementation status of approved WHP plans. More details of tracking can be found in Section V of the program. Direct technical assistance will be provided to all systems requesting support on the development or implementation of their local plan.

The concept of WHP is to advance a prevention-oriented approach to providing safe drinking water to the citizens of Indiana. This effort builds on the current and historic priority the State has placed on safe drinking water.



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II. ROLES, RESPONSIBILITIES AND AUTHORITIES

A. Public Water Supply Systems:

Public water supply systems (PWSSs) will be responsible for preparing local wellhead protection (WHP) plans and implementing programs to help protect wells which they own and manage. Community PWSSs are required to develop and implement wellhead protection plans. The Wellhead Protection Program (WHPP) is voluntary for non-community systems; however, if non-community PWSSs decide to apply for approval, their WHP plans must meet the guidelines established by the IDEM in this program document.

As part of the WHP plan, the PWSS will be required to:

- Develop a local Wellhead Protection planning team;
- Delineate the wellhead protection area (WHPA);
- Inventory potential contamination sources within the WHPA;
- Develop a strategy to manage potential contamination threats within the WHPA;
- Develop an implementation plan;
- Develop a contingency plan to protect the water supply in emergency situations;
- Conduct public outreach programs to educate community members and owners of potential sources of contamination of the consequences of contamination to the drinking water aquifer and practices which can protect the aquifer; and
- Track the activities of existing, as well as, new potential sources of contamination in the WHPA.

It is recognized that PWSSs which serve municipalities but are privately owned may experience difficulty in establishing and operating WHP plans based on municipal authority. The primary obstacle is their limited ability to mandate land use outside the area they own. Because of this, it will be critical for privately owned PWSSs to establish a close working relationship with the municipality they serve. In particular, it is necessary for the planning team to include local government officials.

B. Local Government

Ideally, a local government representative should serve on the local planning team to assure communication between local government agencies. Also, local governments can act as coordinators of WHP activities when WHPAs extend across adjacent political boundaries.

C. State Government

Under the WHPP, the State will have the responsibility to review the local WHP plans and programs including the approval of new well sites. The State will provide the guidelines for developing a comprehensive WHP plan and provide information and technical guidance for the locally initiated public education outreach program. The State will provide technical assistance documents to assist in the development of a WHP plan. The State will also have the responsibility to control the State regulated facilities within the WHPA to protect ground water from contamination. The State will participate in and facilitate the coordination of relevant authorities in inter-state issues. The State will develop ground water education materials which will be used by PWSSs in their public education programs.

1. Indiana Ground Water Task Force

The Indiana Ground Water Task Force was formed in 1989 as a result of the Indiana Ground Water Protection Act (IC 13-7-26). The members of the Ground Water Task Force (GWTF) consist of State agency heads including IDEM, Indiana Department of Natural Resources (IDNR), Indiana State Department of Health (ISDH), Office of the Indiana State Chemist (OISC) and Office of the State Fire Marshal (OSFM) and five non-governmental representatives appointed by the Governor. The five non-governmental members represent labor, agriculture, local government, business, and environmental groups. According to the Indiana Ground Water Protection Act of 1989, the State agencies represented on the GWTF may not permit activities within the protection areas (i.e., wellhead protection areas) that would violate or interfere with the purposes of the rules for well field protection. This implies that the agencies must notify each other when permitting a facility or activity within a WHPA. During periods where the GWTF is in-active (e.g., where appointments have not been made by the Governor's office), the Task Force's WHP workgroup will serve to provide the inter-agency coordination function of the GWTF.

The Indiana inter-agency GWTF is responsible for:

- a. Studying ground water contamination in Indiana;
 - b. Coordinating the State agencies involved with ground water pollution problems;
 - c. Implementing the ground water quality protection and management strategy; and
 - d. Developing policies to prevent ground water pollution.
- The GWTF assigns specific technical issues to workgroups so that ground water

protection policy may be developed. A wellhead workgroup was established in 1990 by the GWTF, and the membership includes representatives from PWSSs, industry, environmental interest groups and local and state government. The workgroup was responsible for the identification of issues and potential policies to address in the WHPP. A subcommittee was formed to discuss delineation, in terms of guidelines, submittal requirements, and criteria for review. The workgroup has provided a mechanism to support the IDEM's program development process. In this, the GWTF Wellhead Workgroup served to provide ideas and concepts to the IDEM during program development. In addition, the Wellhead Workgroup was the primary review committee for the program to insure all perspectives of wellhead protection are incorporated and the program represents a state-wide position.

2. Indiana Department of Environmental Management

The Indiana Department of Environmental Management (IDEM) will oversee and track WHP plan development and submittal, and coordinate with other regulatory programs.

Following are the program areas within the IDEM which will be affected by the State WHPP:

a. Office of Environmental Response

Emergency Response Branch: This Branch has the responsibility to respond to emergency situations associated with ground water contamination. Such emergencies include accidental spills, leaks, releases of hazardous materials above or below ground, etc., within an approved WHPA which may threaten the drinking water supply. In addition to responding in an emergency, this Branch will also be involved in prevention of such spills or leakages.

Underground Storage Tank Branch: This Branch operates through two sections, the Underground Storage Tank Section (UST) and the Leaking Underground Storage Tank (LUST) Section. The UST Section has the responsibility to keep records of all underground storage tanks throughout the State and track tank construction standards. The LUST Section is responsible for the remediation of the soil and ground water which has been contaminated by a leaking tank. The LUST Section will prioritize the remediation of contaminated sites within approved WHPAs. Where underground tanks are located within an approved WHPA, the UST Section and the LUST Section will prioritize underground storage tanks in those locations.

Project Management Branch: This Branch is involved in the administration and project management of voluntary clean-up, Superfund, and State Cleanup sites, and underground tank installation and removal activities.

b. Office of Solid and Hazardous Waste Management

The **Office of Solid and Hazardous Waste Management** (OSHWM) is responsible for regulating solid and hazardous waste facilities, such as , landfills, transfers stations, and storage areas. The OSHWM will be responsible for permitting, inspecting, investigating and overseeing clean up activities of these facilities within WHPA's. Geologist working for the office will work toward the proper siting and ground water monitoring of these facilities. Engineers within the office will ensure that the facilities are properly designed. Inspection components for the office will enforce all appropriate permit conditions and rules ensuring appropriate operation standards of these facilities. WHPAs have been and will continue to be recognized as areas of special concern with regards to solid and hazardous waste management.

c. Office of Water Management

Drinking Water Branch: This Branch is responsible for:

- Development and administration of the WHPP and supporting regulations;
- Inter-agency coordination of the State WHPP between relevant state agencies;
- Approval of well sites for new wells;
- Maintenance of an updated inventory of all PWSSs within Indiana;
- Coordination of state activities in case of local drinking water emergencies, including the provision of maps and locations of approved WHPA's to other IDEM, State, and Federal programs.

Ground Water Section of the Drinking Water Branch will be directly involved in:

- Review of WHP plans submitted by a PWSS;
- Development of technical assistance and guidance documents for delineation, contingency plans, new well site selection, potential source identification and management, and planning teams;
- Development of educational outreach programs for the public and PWS systems;
- Extension of technical assistance to the Compliance Section by providing a ground water vulnerability assessment of the associated WHPA for each waiver application;
- Development and presentation of technical workshops for PWSSs;
- Review of new well sites and well site surveys (when adequate funding becomes available); and
- Geo-location of PWS wells, through the use of global positioning system (GPS) equipment, in delineated WHPAs submitted for approval.

Permit Section will be responsible for reviewing construction plans and specifications, and issuing construction permits for new wells within the WHPA.

Compliance Section will be responsible for:

- Tracking the specific well site chemistry data before a waiver is approved;
- Developing and updating the monitoring waiver package along with the Ground Water Section.

Field Inspection Section will provide inspections of the well sites for sanitary surveys, and emergency ground water contamination situations, and provide direct technical assistance to systems on water concerns. Until adequate funding is available, the Field Inspection Section will continue its present role in field review and approval of new well sites.

Permits Branch: This Branch will be responsible for tracking facility compliance with existing water pollution regulations (i.e., NPDES).

d. Office of Enforcement

This office will respond to all referrals from program areas for non-compliance problems associated with ground water contamination, solid and hazardous waste discharges, emergency response situations, etc. This office will pursue formal enforcement actions against the non-complying PWSSs, when necessary.

e. Office of Pollution Prevention and Technical Assistance

This office develops policies and programs to reduce the generation of municipal wastes, toxic materials and hazardous wastes and pollutants, by means of industrial pollution prevention within the WHPA. Pollution prevention means the employment, by a business or commercial operation, of a practice that reduces the industrial use of toxic materials or reduces the environmental and health hazards associated with an environmental waste at its source, without diluting or concentrating the waste before its release, handling, storage, transport, treatment or disposal.

In conjunction with the Office of Water Management, Drinking Water Branch (and various stakeholders), the Compliance and Technical Assistance Program's Outreach and Education Branch will be developing an Outreach Strategy to help educate government agencies, PWSSs and community representatives on the importance of WHP and how to implement a local program.

3. Indiana Department of Natural Resources

The Department of Natural Resources is involved in ground water related activities of both a regulatory and resource evaluation nature. Three primary divisions are involved: Division of Oil and Gas, Division of Reclamation, and Division of Water.

The Division of Oil and Gas regulates the construction, drilling, and abandonment of oil and gas wells, and injection wells (i.e., UIC Class II) that may be used to dispose of brine waters recovered during the production of oil and gas.

The Division of Reclamation is involved in a variety of regulatory concerns, primarily coal mining activities impacting ground water. Data on ground water quality, aquifer depth, yield, hydraulic characteristics, flow direction, etc. are required for the division's permitting process.

The Division of Water houses the database for Indiana's water well records and is involved in studies of ground water resources based on geographical areas, such as basin or county-wide studies, or locally in the case of special studies. Construction standards for water wells, monitoring wells and geo-thermal wells (including grouting and abandonment, etc.) have been established as part of the licensing and regulation of the water well drillers. Water use data and information on high capacity wells is also maintained and is included in the management considerations of the State's water resources.

4. Indiana State Department of Health

The Indiana State Department of Health (ISDH) is responsible for general supervision and control of matters relating to the preservation and protection of public health. Their programs include regulation of all on-site sewage disposal systems which can directly impact local ground water quality and drinking water safety. The ISDH works closely with the county health departments through guidance and permitting of residential and commercial septic systems.

5. Office of the Indiana State Fire Marshal

The State Fire Marshal's responsibilities concern the storage of materials which present a fire or explosive hazard and on-site guidance to other officials when emergency conditions involve a fire or explosion. The State Fire Marshal must assure that flammable or explosive materials are stored in a manner to prevent fire and explosion hazards and make sure these hazardous substances are not discharged to the ground water.

6. Office of the Indiana State Chemist

The Office of the Indiana State Chemist (OISC) regulates the use, storage, and application of registered pesticides, and the storage and containment of bulk fertilizers. Pesticide application restrictions are contained on federally-mandated pesticide product container labels. Further restrictions on the use of a specific pesticides may be developed by the OISC through the Indiana Pesticide Review Board.

7. Other State Agencies

Other state agencies will cooperate with the IDEM to regulate potential contaminant sources within WHPAs and coordinate between parties involved in the process of WHPP implementation.

Other state agencies involved in ground water protection are: the Indiana Utility Regulatory Commission (IURC), the Department of Commerce (DOC), the Indiana Geological Survey (IGS), and the Indiana Department of Transportation (INDOT). The (IURC) reviews and determines requests for rate increases due to the requirements of the Wellhead Protection Program and regulations. The (DOC) may provide funding assistance for Wellhead Protection where funds are available. The IGS will provide the IDEM and the OISC with ground water sensitivity maps and the IGS will conduct a detailed hydrogeological study of selected well fields in which the vulnerability is not certain. The INDOT will oversee issues related to road salt use and routing of hazardous cargo.

D. Federal Agencies

1. U.S. EPA

The United States Environmental Protection Agency (U.S. EPA) has the responsibility to coordinate available grant support, technical assistance to State agencies regarding public domain computer software packages used for WHP, and procedures for environmental risk assessment.

The U. S. EPA provides oversight authority for several source control programs (i.e., RCRA-C & D, NPDES, UIC-Class II, pesticide registration, etc.). The EPA will continue oversight responsibilities for these programs and will coordinate regional and national priorities with the Indiana WHPP. In addition, the U.S. EPA provides primary implementation authority for site clean-up of National Priority List (NPL) sites under the federal Superfund program and primary authority for the permitting and enforcement of Class V underground injection wells. Further, the U.S. EPA provides oversight of the Indiana Public Water Supply Supervision program. In this, EPA Region V will ensure effective coordination between the priorities under the Public Water Supply Supervision program and the Indiana WHPP.

The U.S. EPA has established an information hotline for the Safe Drinking Water Program. This hotline provides assistance and regulatory information to the public, the regulated community, and PWSSs on regulations and programs developed in response to the SDWA Amendments of 1986. In addition, U.S. EPA wellhead

protection documents may be requested through this hotline.

The U.S. EPA will thoroughly review the Indiana WHPP to assess the completeness of the program in accordance with the provisions of the SDWA, Section 1428. The U.S. EPA will also provide technical assistance to all state agencies in both the development and implementation stages of the WHPP.

2. Other Agencies

The U.S. Geological Survey (USGS) and the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) provide hydrogeological data and issue detailed maps containing technical information necessary for the delineation of WHPAs. The U.S. Department of Agriculture cooperative extension service provides technical assistance in managing agricultural practices which may adversely affect the quality of ground water.

Federal facilities are required to abide by state regulations. IDEM will be available to advise and work with local PWSS's serving federal facilities as needed.

E. Regional Planning Agencies

There are many regional planning organizations throughout Indiana which work on an array of regional issues. Regional planners typically coordinate efforts, such as transportation planning, air quality, and water quality. Many issues are related to public water supplies, wastewater treatment, ground water protection and non-point source pollution. These agencies include:

- Michiana Area Council of Governments (MACOG),
- Ohio-Kentucky-Indiana Regional Council of Governments (OKI),
- Northwest Indiana Regional Planning Commission (NIRPC),
- Ohio River Basin Sanitation Commission (ORSANCO).

F. Local Level Groups

A partnership between PWSSs and other local and county agencies should be a part of the development and implementation of WHP plans. Several different county and local offices may participate in the local planning and implementation process, for example:

- Administrative officials,
- County soil conservation districts,
- County health department,

- Fire marshals and/or inspectors,
- Land use planning and zoning,
- Municipal engineers,
- Wastewater treatment plant operators,
- County planning departments,
- Local Water supply organizations,
- Cooperative Extension Service (CES).

Close coordination and communication among all local officials, as well as with State and Federal agencies, is a key element to a successful WHP plan. Responsibilities of other local agencies are as follows:

- Municipal Public Works:
WHP planning, implementation and coordination;
- County Planning (Departments/Boards/Commissions):
Land-use controls for WHP;
- County Health Departments:
Source control regulation, educational outreach, information management, technical assistance;
- Planning Committees:
Information management, WHP implementation/coordination support;
- Water Suppliers/Private Water Supply Utilities:
WHP planning, implementation and coordination;
- Local representatives of Water Supply Organizations, such as:
Indiana Water and Wastewater Association, Indiana Rural Water Association, and American Water Works Association;
- Technical assistance, workshops, coordination and education;
- Consultants:
Hydrogeological and technical consulting, preparation of WHP plans, ground water monitoring, delineation, etc..

G. Local Planning Team

It is critical to form a local planning team (LPT) to facilitate the development of the local WHP plan. PWSSs will have the primary responsibility to form the local planning team. The LPT must have representation of parties which may be affected by the development and implementation of the WHP plan. The PWSS must public notice the formation of a LPT in the newspaper of largest circulation within the area where the LPT is being formed. IDEM recommends that a local planning team consist of at least three committees:

1. The WHP Advisory committee;
2. The Emergency Planning committee;
3. The Educational Outreach committee;

The local WHP Advisory committee should provide specific guidelines to implement all segments of the comprehensive WHP plan, such as the delineation of the WHPA, source identification, management strategy, etc. The advisory committee should resolve problems regarding any aspect of the program which can be handled through local coordination.

The Emergency Planning committee should coordinate activities during emergency situations, such as accidental spills, leakage found within the WHPA, etc. The Emergency Planning Committee should act according to the provisions described in the local contingency plan and keep in close contact with the local officials and the public during emergencies. A detailed description of the contact personnel requirements for contingency plans are provided in the contingency plan section of this document. The Emergency Planning committee should inform the community members about their responsibilities and take necessary steps to prevent ground water contamination.

The Educational Outreach committee should organize community members and should have a thorough understanding of the existing WHP plan. The Educational Outreach Committee should have the responsibility to educate the public and the potential sources of contamination about what they can do to protect ground water and inform them of the consequences of not protecting the WHPA through proper management practices. The Educational Outreach Committee should formally communicate with community members by organizing meetings, hearings, etc.


The size of the planning team will vary from one community to the next. It is important that the planning team represent all interests of the community. The leader of the local planning team should be someone who can keep the planning team organized and focused. This program requires a minimum of one (1) person from the affected by the development and implementation of the WHP plan be a participant of the local planning team.

Suggested members for the local planning team include the following:

- Local and/or county health department;
- Fire department;
- Police department;
- City administration;
- Local and/or county planners;
- Industry and/or business;
- Commerce;
- Local environmental conservation group;
- Local neighborhood association;
- Department of Transportation;
- Farming community;
- Water purveyors;
- Community service organizations (ex. League of Women Voters, Rotary Club, Lions Club);
- Concerned citizens within the WHPA;
- Local representative of USDA Natural Resources Conservation Service (USDA-NRCS);
- Cooperative Extension Service (CES).

Once a team has been formed, it should first define goals and objectives prior to defining the specific responsibilities of the individuals in the team. Further information on the roles of subcommittees, and the development of a local planning team will be provided in a future technical assistance document.

III. Delineation of Wellhead Protection Areas



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III. DELINEATION OF WELLHEAD PROTECTION AREAS

A. Definition

In Indiana, a wellhead protection area (WHPA) is the surface and subsurface area, delineated by fixed radius, hydrogeologic/geomorphic mapping, analytical, semi-analytical or numerical flow/solute transport methods, which contributes water to a PWSS well and through which contaminants are likely to move through and reach the well over a specified period of time.

The specified period of time or time of travel (TOT) threshold is chosen to suit the hydrogeologic conditions and needs of the community: **a five (5) year TOT when modeling WHPAs, and 3,000 ft. when using the fixed radius method is minimum allowed TOT in Indiana. However, all systems are strongly encouraged to delineate WHPAs beyond the minimum criteria to effect a greater level of protection.**

B. Purpose of WHPA Delineation

The purpose of delineating the WHPA is to identify the well field management area. The WHPA outlines the chemical contamination response area and where potential source inventories are performed and management strategies are implemented.

C. Methods for Delineation

The methods for delineation were chosen by the Wellhead Workgroup. Methods were selected based on ease of use and understanding, economy of development and implementation, ability of method to account for local geology, and technical defensibility of the method (*See Table III.1*).

The delineation of the WHPA is based on the physical processes governing ground water flow. The Indiana WHPA delineation is based on time of travel (TOT) criteria or distance criteria. The TOT is the distance traveled by a drop of water through an aquifer to the well or well field for a specified period of time. The TOT for calculating the WHPA is determined by the PWSS, with a minimum five year TOT allowed. The WHPA size and shape will vary, depending on hydrogeological features, including ground water divides, surface water features, hydraulic gradient, and specified TOT.

Table III.1 Rational for Method Selection

Method	Description	Rational for Selection	Rational for non-Selection
Arbitrary Fixed Radius	Fixed radius around well representing zone of contribution	Radius distance based on modeled capture zone. Easy to implement for small systems.	
Calculated Fixed Radius	A circle around the well based on a specified TOT criterion. The radius of the circle is based on the volumetric equation.		May be inaccurate, especially where significant hydrogeologic boundaries are present and/or aquifer is heterogeneous and non-isotropic.
Simplified Variable Shapes	"Standardized forms" are generated using analytical models, variable flow boundaries and TOT criteria. The appropriate standardized form is selected to fit the hydrogeologic conditions present at the site.		Not accurate in areas with geologic heterogeneities and hydrologic boundaries. Also, local flow gradients may differ from the regional gradients used to calculate the standardized forms.
Analytical and Semi - analytical methods	A computer model which uses well hydraulics and ground water flow equations to define the area of contribution.	Most analytical models can account for some heterogeneity, as well as various confinement conditions and linear boundaries.	
Hydrogeologic/ Geomorphic Mapping	Mapping of flow boundaries and geomorphic features which define the capture zone.	Most appropriate method to delineate WHPAs in a conduit-flow karst situation, or other hydrogeologically complex settings.	
Numerical Flow/ Solute Transport Models	A computer model which uses a combination of complex numerical ground water flow equations to delineate the areas of contribution.	Very accurate and flexible. Can account for most hydrogeologic situations including heterogeneity, anisotropy and multiple aquifer systems.	

Using a TOT greater than 5 years in conjunction

with a management strategy may allow additional time to protect water supply wells from contamination. This may be advantageous in cases where the PWSS or community could not respond to a acute chemical contamination within five years.

Several different techniques may be used to delineate a WHPA; ranging from simple fixed radius to numerical flow/solute transport modeling. Under Indiana's WHPP, five methods are approved for use in delineating a WHPA. The approved methods are listed below and a comparison of methods is presented in *Table III.2*.

1. Fixed radius
2. Analytical models
3. Semi-analytical models
4. Numerical flow/transport models
5. Hydrogeologic/geomorphic mapping

1. Fixed Radius Method - In situations where small systems are located in an area where the aquifer is highly transmissive, a modeled WHPA will be a narrow stretch of land extending from the well toward the source area. As the ratio of transmissivity to well discharge increases, the delineated WHPA becomes so narrow that the accuracy of the boundaries becomes questionable. The WHPA may shift in direction depending on the annual seasonal flow dynamics. With this in mind, numerous model simulations delineating a WHPA were performed using various hydrogeologic conditions found throughout the state. It was found that a 3,000 ft. radius circle representing a five year TOT, the State's minimum TOT threshold, would be sufficient for the majority of cases with medium to highly transmissive aquifers pumping at 100,000 gpd. A summary of the modeling efforts which determined the 3,000 ft. radius are presented in *Appendix I*. Based on the model simulations the fixed radius was set as a circle around the well with a 3,000 ft. radius.
2. Analytical methods - These methods use well hydraulics and ground water flow equations to define the area of contribution to the well or well field. Computer models allow for multiple wells and determine a TOT related WHPA. Analytical methods generally assume two dimensional flow, aquifer homogeneity and isotropy and a uniform regional flow gradient.

3. Semi-analytical methods - These methods use well hydraulic equations describing the distribution of drawdown surrounding a production well in combination with the regional distribution of head using the theory of superposition. The values of drawdown are used in conjunction with a particle tracking program to delineate the TOT related WHPA. This method requires site specific values for aquifer properties, which are best determined by aquifer tests and detailed potentiometric surface measurements.
4. Numerical flow/solute transport models - These methods use a combination of complex numerical ground water flow equations to delineate areas of contribution to the well or well field. The method requires detailed hydrogeologic information. Some aquifer heterogeneities can be taken into consideration when the WHPA delineation is performed using a numerical model.
5. Hydrogeologic/geomorphic mapping - These methods utilize geologic, geophysical, or geomorphic characteristics of the aquifer and aquifer materials. Typical methods for hydrogeologic/geomorphic mapping incorporate identification of ground water flow divides, recharge areas, and aquifer boundaries (as depicted by lithologic or depositional changes in the aquifer and confining materials) to determine the extent of the wellhead capture zone. Geomorphic determinations include topographic analysis of the surface which corresponds to ground water drainage divides and identification of springs and fractures which constitute portions of the ground water flow system. Dye tracing techniques, particularly useful in carbonate/karst aquifers, allow delineation of fracture or conduit subsurface drainage basins and time of travel of ground water flow under conduit or fracture flow conditions. Permission to use hydrogeologic/geomorphic mapping, as the sole means for delineating the WHPA, must be obtained from IDEM, Office of Water Management, Ground Water Section. Permission will be granted on a site-by-site basis and will be approved where other methods are not valid, e.g., where a conduit-flow karst aquifer is being utilized and fixed radius, analytical, semi-analytical, numerical flow/solute transport methods cannot account for these conditions.

D. Method Eligibility

Not all delineation methods are available to every system. The following discussion provides criteria for the eligibility of systems to use a particular method. Method eligibility is also shown in *Table III.2*.

1. Fixed Radius - The 3,000 ft. minimum radius is given as an option considering the affordability of the smaller systems and the degree of confidence of WHPA boundaries in certain geologic conditions.

A PWSS may use the Fixed Radius Method after receiving prior approval from the IDEM. Approval to use the Fixed Radius Method is based on the following criteria:

- a. A PWSS does not qualify as a significant water withdrawal facility (in accordance with IC 13-2-6.1); or
- b. A PWSS qualifies as a significant water withdrawal facility, in accordance with IC 13-2-6.1, and the average daily withdrawal is less than one hundred thousand (100,000) gallons per day demonstrated by:
 - Submittal of annual total pumping data for the previous five (5) years of operation to the department; and
 - Statistical determination by the department of an upper confidence interval of one hundred thousand (100,000) gallons per day or less by the following formula:

$$\bar{x} = t_{(0.95, n-1)}(S/n^{1/2})$$

where:

- \bar{x} = Mean of pumping data
- S = Standard deviation of pumping data
- $t_{(0.95, n-1)}$ = t statistic at 95%, n degrees of freedom
- n = Number of observations

2. **Analytical, Semi-analytical and Numerical Flow /Solute Transport**
These three methods are available to all PWSSs.
3. **Hydrogeologic/Geomorphic Mapping Method** - A PWSS may use the Hydrogeologic/Geomorphic Mapping Method as the sole method of delineation only with prior approval from the department.

Table III.2 Comparison of Delineation Methods and Method Eligibility.

Method	Advantages	Disadvantages	Delineation Method Eligibility
Fixed Radius	Easy to apply. No field data required.	Not designed to site. May be managing an area larger or smaller than the true WHPA	Available to PWS systems which qualify as non-significant water users or upon approval by the department
Analytical and Semi-analytical	Most analytical models can account for some heterogeneity. Also, confined, unconfined conditions and linear boundaries.	Site specific data needed. Uses simplifying assumptions which limit the flexibility of the model. Applicable to hydrogeologically simple sites only.	Available to all PWS systems.
Hydrogeologic/ Geomorphic Mapping	Most appropriate method to delineate WHPAs in a conduit-flow karst situation.		Only with prior approval of the department.
Numerical flow/solute transport	Most accurate. Very flexible. Can model most hydrogeologic situations. Spatial variation, heterogeneity, anisotropy, and multiple layers may be integrated into the model.	Need trained personnel to run model. Need site specific data. Validity of model may depend on amount and quality of site specific data.	Available to all PWS systems.

E. Choosing a Model

Selecting an appropriate WHPA delineation method requires the consideration of the hydrogeologic setting, WHP management plans, and resources. Choosing a delineation method is often a balance between the need for accuracy and the available resources. The following list are items for consideration in selecting a delineation method. Further explanation of these factors is given in *Appendix II*, and a comparison of delineation methods is presented in *Figure 4*.

1. Hydrogeology

A model simulates site specific ground water flow conditions. Different models can simulate different hydrogeologic situations, therefore, it is important to choose a model which can best simulate the flow regime at the site. To best match a model to site hydrogeological features, the site hydrogeology must first be characterized.

A hydrogeologic characterization essentially gathers and assembles information into a format for assessment. Information for site characterization includes: 1) type of aquifer material; 2) hydraulic properties of aquifer; 3) type of aquifer confinement; 4) flow boundaries; and 5) local flow gradients and flow directions. Further explanation of these hydrogeologic properties is found in *Appendix II*. Information for hydrogeologic characterization is found in public domain files (e.g., USGS Water Resources Investigations, Indiana Geological Survey Reports, Masters' thesis, etc.) and various site-specific data such as test borings, pumping tests, and water level measurements.

Because of the complexity and volume of information gathered, the data should be organized to be evaluated more readily. This takes the form of cross-sections across the area, various hydrogeologic maps, and tables. These cross sections, maps and tables are also required for submittal to IDEM for review, and are listed in more detail under submittal requirements within this section.

2. System Stress and Management Plans

When choosing a delineation method, consideration should also be given to: 1) current and anticipated size of system; 2) WHP goals and management strategies; 3) defensibility of chosen method; 4) well field geometry; and 5) nearby pumping centers.

3. Resources

For many PWSSs a major consideration in the selection of a delineation method is the availability of resources, including equipment, technical expertise, and monetary resources. It is important that the person(s) conducting the WHPA delineation have a thorough knowledge of hydrogeology. Site characterization and WHPA delineation, using analytical, semi-analytical, numerical flow/solute transport or hydrogeologic/geomorphic mapping methods, must be performed by a qualified ground water scientist. Since equipment or technical expertise may be obtained by hiring a consultant, the ability to delineate using the most desirable method may ultimately depend on available budget. Recognizing the need to budget and the limitations of smaller systems, the time for Phase 1 submittal is varied, depending on the size of the system (*See Table I.1*). The intent of the variable time frame is to allow the PWSS to consider both the type of delineation they desire and to allow adequate time to budget for the delineation.

With an understanding of method eligibility, site-specific hydrogeology, and management plans, a WHPA delineation method can be selected that best balances the level of accuracy required with available resources.

It may cost a community more to delineate using an analytical model than the fixed radius method. However, for a system pumping from a aquifer with low transmissivity, the fixed radius method will probably contain areas that have no effect on the water supply based on time of travel. An analytical model would provide a more accurate delineation of the area that needs to be protected, have greater defensibility and ensure a greater degree of confidence to the community.

F. Submittal Requirements : Phase I

As a part of the WHP Plan, PWSSs are responsible for gathering the information necessary to delineate the TOT as specified. A WHPA delineation using modeling methods or hydrogeologic/geomorphic mapping methods must be performed by a qualified ground water scientist. A “Qualified Ground Water Scientist” is defined as an individual who possesses a bachelor’s degree or higher in the natural sciences (e.g. Geology) or engineering with sufficient level of experience to make sound professional judgements regarding site characterization and hydrogeology. This level of experience may be exhibited with certification as a professional geologist or engineer, either of whom shall have education or professional experience in hydrogeology or ground water hydrology.

Site characterization and WHPA delineation, using modeling methods, or hydrogeological mapping methods must be performed by a qualified ground water scientist.

All maps submitted, except U.S.G.S. topographic maps must be drawn to a scale between 1" = 400' and 1" = 1,000'.

Phase 1 - Under Phase I of the WHP Plan, the PWSS is required to submit the following:

1. Fixed Radius

A PWSS that, after approval from the department, delineates the WHPA using the Fixed Radius Method must submit the following data to the department:

- a. A map depicting:
 - the wellhead protection area boundary;
 - the PWSS pumping well(s) locations; and,
 - the location of other significant water withdrawal facilities in the area;
- b. A topographic map of the area; and,
- c. Well logs for the PWSS pumping well(s).

2. Analytical, Semi-Analytical or Numerical Flow/Solute Transport

When a PWSS delineates the WHPA using an analytical, semi-analytical or numerical flow/solute transport model, a report with a narrative description of the regional hydrogeologic setting, the conceptual model, and modeling efforts must be submitted. The report must include the following:

- a. An analysis of the hydrogeologic setting and the conceptual model including:
 - Map of the area of interest;
 - Review of published hydrogeologic and geologic interpretations over the area of interest;
 - Geologic cross sections¹ showing:
 - hydrostratigraphic units;
 - water levels;
 - relationship of surface water bodies to the hydrostratigraphic units; and
 - pumping wells with screened intervals;
 - Well logs and records used in cross-section development;
 - Map(s) which illustrate over the area of interest:
 - location of PWSS wells;
 - other high capacity wells in the area;
 - surface water features located within the area of interest;
 - thickness and extent of hydrostratigraphic units¹;

1

Must be performed by or under the supervision of a Certified Professional Geologist and bear his/her seal or be performed by a) an officer or employee of the federal, state or local government while engaged in providing geological services for the officer's or employee's employers, b) a person engaged solely in geological research or instruction of geology, c) a professional engineer registered under IC 25-31 who applies geology to the practice of engineering.

- regional water levels; and
 - bedrock topography¹;
 - Summary of raw data used in the development of the conceptual model;
 - Discussion of hydrogeologic parameters;
 - Discussion of the ground water flow system including:
 - distribution of recharge;
 - current PWSS pumping rates and planned changes in pumping rate; and,
 - pumping rates of neighboring high capacity wells;
- b. Presentation and discussion of the modeling effort must include:
- The rationale for delineation method selection;
 - A tabulated summary of the model input parameters showing the range over which the parameters were varied;
 - An example input file;

¹ Must be performed by or under the supervision of a Certified Professional Geologist and bear his/her seal or be performed by a) an officer or employee of the federal, state or local government while engaged in providing geological services for the officer's or employee's employers, b) a person engaged solely in geological research or instruction of geology, c) a professional engineer registered under IC 25-31 who applies geology to the practice of engineering.

- Map(s) showing:
 - the domain of the modeled area within the area of interest;
 - location of any boundary conditions used;
 - calibration target locations, if used;
 - modeled potentiometric surfaces; and
 - resultant WHPA boundaries;

- A discussion of :
 - assumptions used in the modeling effort;
 - changes made to initial conditions;
 - calibration analysis if used;
 - water budget of the model, if available; and
 - effects of uncertainty in input parameters and boundary conditions on modeled WHPA boundaries.

3. Hydrogeologic/Geomorphic Mapping Method

A PWSS that delineates the WHPA using the Hydrogeologic/Geomorphic Mapping Method must submit data as required and agreed to by the IDEM and the PWSS.

Phase II

Following Phase I approval of the WHP plan, the PWSS will have 5-10 years (*See Table I.1*) to submit Phase II of the WHP plan for final approval. Phase II submittal requirements concerning WHPA delineation include:

1. An updated Phase I submittal reflecting changes, if any; and
2. A discussion describing how the updated WHPA compares with the previously delineated WHPA.

Due to seasonal water level data collected during the interim between Phase I and Phase II, the updated WHPA may differ from the initially delineated WHPA. In this situation, the PWSSs will be required to combine both initial and updated WHPAs to define their final WHPA for WHPP approval by IDEM. However, if, based on better non-transient data, the WHPA delineation is better defined in Phase II the newly defined WHPA would be submitted to IDEM.

G. IDEM Review Criteria

Review of submitted wellhead protection programs will be performed by the IDEM's Drinking Water Branch. The WHPA review criteria was developed, in part, by a subcommittee of the Wellhead Workgroup. The subcommittee included representation from the USGS, IGS, IDNR, IDEM, industry, environmental groups and consulting firms.

1. Review Criteria for Fixed Radius Method

In reviewing a WHPA which has used a fixed radius method, the IDEM will determine if the PWSS has hydraulic parameters which fall above or below the average parameters (determined by review of published reports). For example, is the transmissivity for the area of the PWSS much greater than 20,000 ft²/d, the value used to model the 3,000 ft. radius? To determine these hydrogeologic parameter values, IDEM may examine or use tools such as:

- The pumping history of the PWSS ;
- Published reports of the area in which the PWSS is located;
- Unpublished reports and files held at IDEM; and,
- Analytical or semi-analytical modeling.

2. Review Criteria for Analytical, Semi-Analytical, Numerical Flow/Solute Transport and Hydrogeologic/Geomorphic Mapping Method

Under Indiana's WHPP, delineations submitted to the IDEM will be reviewed according to the following general criteria:

- The completeness and accuracy of the data used to determine the hydrogeologic conceptualization; and
- The information submitted demonstrates that the chosen delineation method properly accounts for site specific hydrogeology.

After review, the IDEM may require additional data to be submitted. Additional data may be required when further information is needed to support justifications of delineation method or to verify assumptions used in modeling.

Based on the hydrogeologic setting, the IDEM may require the PWSS to use a different method to delineate the WHPA (e.g., a PWSS withdrawing water from a conduit-flow karst aquifer). Analytical, semi-analytical and numerical models, as well as the fixed radius approach, may not be appropriate for delineation of a WHPA in a karst aquifer. Based on site specific information, systems which exhibit conduit-flow regimes must propose an appropriate delineation methodology for the approval by the IDEM, such as dye tracing or basin analysis (paleo-topographic analysis).

H. Relationship between Delineation and Source I.D./Management

As previously stated, the purpose of delineating the WHPA is to identify a wellfield

management area within the area of contribution. In considering management options, delineation of a WHPA allows the PWSS and the community to consider where the ground water comes from and an estimate of how long the ground water takes to reach the well system from a particular area. With this information, the PWSS and the community are better equipped to protect their water supply from contamination. Management of the WHPA will vary with management strategy but, in general, the WHPA outlines the area where source inventories are performed, owners/operators of potential contaminant sources are educated, best management practices are adopted, public education is performed, and zoning regulations, if used, are implemented.



IV. Identification and Inventory of Potential Sources of Contamination

- A. Purpose of Source Identification.....IV-1
- B. Submittal Requirements.....IV-4
- C. IDEM Review Criteria.....IV-5
- D. On-going Activities.....IV-5

IV. IDENTIFICATION AND INVENTORY OF POTENTIAL SOURCES OF CONTAMINATION

A. Purpose of Source Identification

An inventory of potential sources of contamination or source identification (ID.) provides an opportunity to identify any past, present, and proposed activities that may pose a threat to the well(s) or well field. This includes any new activities and changes in the operational status of previously inventoried facilities. Maintaining an accurate and complete inventory of potential sources of contamination is of the utmost importance to safeguarding a community's drinking water and an essential part of the Wellhead Protection plan.

Indiana's WHPP requires community public water supply systems (PWSSs) to complete an inventory of all potential sources of contamination (including those sources controlled through regulatory approaches and unregulated sources such as non-point sources) within the wellhead protection area (WHPA). The PWSS is encouraged to begin the initial source identification and inventory process in the early stages of WHP planning. The source and inventory aids in developing an appropriate management strategy for the community's circumstances. Once the potential sources of contamination are known, options to eliminate or manage the contamination threat can be considered.

To assist PWSSs in the identification of the types of activities to consider, *Table IV.1* lists various types of ground water contamination and *Table IV.2* lists various inventory procedures; a combination of these tools will be required to conduct a complete inventory. More specific guidelines for source ID. will be provided in a technical assistance document focussed on the inventory and management of potential sources of contamination.

A potential source of contamination may pose a threat to the ground water for a variety of reasons. Some reasons are intrinsic to the substance such as toxicity and mobility. Physical factors, which can increase the risk of contamination to ground water, include concentration and volume of substances stored, proximity to water supply wells, operational procedures, maintenance, closure status, the design and age of facility, and local hydrogeologic vulnerability.

TABLE IV.1 POTENTIAL CONTAMINANT SOURCES (listed alphabetically)

<p>AGRICULTURAL</p> <p>Animal burial areas Animal feedlots Chemical application (e.g., pesticides, and fertilizers) Chemical storage areas Irrigation Manure spreading and pits</p> <p>COMMERCIAL</p> <p>Airports Auto repair shops Boat yards Construction areas Car washes Cemeteries Dry cleaning establishments Educational institutions (e.g., labs, lawns, and chemical storage areas) Gas stations Golf courses (chemical application) Jewelry and metal plating Laundromats Medical institutions Paint shops Photography establishments/printers Railroad tracks and yards/maintenance Research laboratories</p>	<p>Road deicing operations (e.g., road salt) Road maintenance depots Scrap and junkyards Storage tanks and pipes (above- ground, below-ground, underground)</p> <p>INDUSTRIAL</p> <p>Asphalt plants Chemical manufacture, warehousing, and distribution activities Electrical and electronic products and manufacturing Electroplating and metal fabrication Foundries Machine and metalworking shops Manufacturing and distribution sites for cleaning supplies Mining (surface and underground) and mine drainage Petroleum products production, storage, and distribution centers Pipelines (e.g., oil, gas, coal slurry) Septage lagoons and sludge Storage tanks (above-ground, below-ground, underground) Toxic and hazardous spills Wells - operating and abandoned (e.g., oil, gas, water supply, injection, monitoring and exploration) Wood preserving facilities</p>	<p>RESIDENTIAL</p> <p>Fuel storage systems Furniture and wood strippers and refinishers Household hazardous products Household lawns (chemical application) Septic systems, cesspools, water softeners Sewer lines Swimming pools (e.g. chlorine)</p> <p>WASTE MANAGEMENT</p> <p>Fire training facilities Hazardous waste management units (e.g, landfills, land treatment areas, surface impoundments, waste piles, incinerators, treatment tanks) Municipal incinerators Municipal landfills Municipal wastewater and sewer lines Open burning sites Recycling and reduction facilities Stormwater drains, retention basins, transfer stations</p>
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Source: United States Environmental Protection Agency. 1989

Wellhead Protection Programs: Tools for Local Governments. EPA 440/6-89-002

TABLE IV.2 Recommended Inventory Procedures

Method	Consists of:	Outcome	Required or Recommended
Outreach Programs	Public meetings, workshops, brochures, public service announcements, and newsletters	Gain local support and cooperation for WHP.	Recommended
Windshield Surveys	Drive through WHPA and locate/verify businesses and land use practices which could be a potential source of contamination.	Familiarize staff with WHPA and verify base map	Recommended
Site Inspections	Inspections of facilities	Very useful in obtaining additional information on potential sources of contamination.	Recommended
Records Review	<p>Search of public records (e.g.; State Databases)</p> <ul style="list-style-type: none"> · Remedial status of RCRA, Superfund or State Clean-up Sites. · UST Files · Emergency Response-Spills · Sara Title III · Hazardous waste handler · Zoning maps · Property ownership maps · Fire-insurance maps, etc. 	Useful in obtaining information on potential sources of contamination both past and present	Required

B. Submittal Requirements

Source ID. submittal requirements for the program are as follows:

1. Phase I

An inventory of all potential sources of contamination consisting of a complete list of existing facilities, sites, practices, and activities for both regulated and unregulated. Source information should be compiled into a format which is easy to access and update by the PWSS. A recommended format for source inventory can be found in *Table IV-3*. The inventory of sources identified shall be submitted in the following forms:

- a. A narrative description of land use within the wellhead protection area (WHPA);
- b. A map with potential sources of contamination plotted, showing their locations, and an inventory of land use (i.e., zoning, distribution, agriculture areas, etc.);
- c. A table containing information describing the potential sources of contamination including:
 - An identification number (cross-referenced to the map with locations of potential sources of contamination);
 - Facility name and location;
 - Site description (which may include facility history (how long the facility has been operating), how long the type of chemical(s) or structure(s) listed have been used, previous practices at the site, etc.);
 - Any environmental permits issued for the site, including number and agency issuing the permit; and
 - Operating status of site (i.e., remedial status, closure, corrective action, etc.).

2. Phase II

- a. A Phase II source ID. updating the source inventory provided in the Phase I submittal.
- b. A comment summary, reporting problems or concerns regarding the WHP plan and the source inventory.

C. IDEM Review Criteria

IDEM shall review Phase I and Phase II submittals based on the following criteria:

1. The completeness of the specific data supplied regarding the facility, site, practice, and activity, including:
 - The inventory, permit or identification number and location of all potential sources of contamination;
 - Identification of all potential sources of contamination in the WHPA on a map (scale of 1"= 400' and 1"=1,000') which includes the boundaries of the time of travel; and
 - The characterization of potential sources is sufficient to develop a management plan .
2. IDEM will evaluate Phase II based on the completeness of the update to adequately characterize the status of all potential sources of contamination identified and inventoried under Phase I, and any new potential sources of contamination that have located within the WHPA.
3. IDEM will evaluate the updates made to the potential sources of contamination inventory every five (5) years, as required, for completeness with respect to the status of all potential sources of contamination identified in the Phase I and Phase II submittals.

D. On-going Activities

The PWSS will track the status of potential sources within their WHPA according to the following:

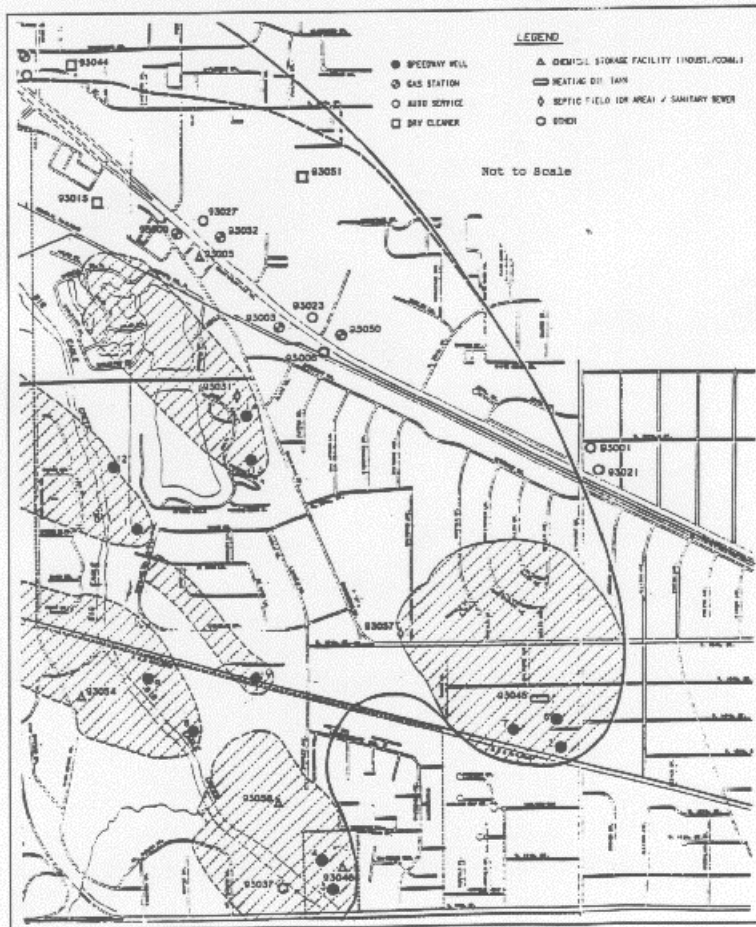
1. The location of new sources established in the WHPA;
2. Closure of existing sources; and
3. Continual update of the source ID. inventory.

This information will be supplied in status reports which will be submitted to IDEM on a five (5) year, continual basis.

Table IV.3 - Example Reporting Format for Potential Source Inventories

ID. Number	Facility Name and Location	Site Description	Permit Number and Type	Type of Contaminants	Operating Status
0	9302 Bob's Gas-Mart 120 S. 12th St.	UST's (3)	U-32-91-IN	BETX, MTBE, Gasoline, etc.	Operating
		Class V Well (garage bay)	N/A	Solvents, oil	Operating
6	9305 EZ-Chem 3245 N. Hammer	Chemical Storage	R-19-80-IN	VOC's, PCB's	Closed 9/14/92
5	9301 Steve's Cleaners 15 So. 9th Ave.	Dry Cleaners	N/A	PCE	Operating
7	9303 1st Street Dump 1501 S. 1st St.	Solid Waste Landfill	S-37-93-IN	Municipal Waste, VOC's, SVOC's, Possible PCB's	Operating
7	9305 State Road 99 (Mile numbers 34, 36, 45, 51, 63, & 77)	Storm water drainage wells (6)	N/A	Highway runoff (e.g., metals, VOC's, petroleum, solvents, etc.)	Operating
0	9303 Stop-N-Fuel 3456 N. 18th St.	UST's (6) **LUST site**	U-99-89-IN L-03-93-IN	BETX, MTBE, Styrene	Closed, under LUST Clean-up
6	9300 Johnson's Farm RR 3201 SR 66 (990 acres)	Farm fields, Confined animal feeding lots, pesticide storage	LA-32-86-IN	Pesticides, animal wastes (nitrates, phosphorus, etc.)	Operating

Figure 5 - Example of a Source Inventory Map (from: HNTR, 1993, U.S EPA Wellhead Demonstration Project, Speedway, Indiana -- Final Report)



IV-6

Figure 5

IV-7

V. Management Approaches of Wellhead Protection Areas

A. Management Objectives.....	V-1
B. Management Areas.....	V-3
C. Management Submittal Requirements.....	V-3
D. Management Strategy and Review Criteria.....	V-5
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F. Coordination of State and Local Authorities.....	V-7
G. IDEM Management Plan Tracking.....	V-8

V. MANAGEMENT APPROACHES OF WELLHEAD PROTECTION AREAS

The protection of public water supply systems (PWSSs) from contamination is primarily based on the appropriate management of potential sources of contamination within the wellhead protection area (WHPA). In this, a major component of a PWSS's local Wellhead Protection plan will be the development and implementation of a management strategy (Phase I). Under the Indiana WHPP, PWSSs will be required to develop a management strategy which outlines the actions the PWSS will initiate to manage specific potential sources of contamination in order to protect the quality of the ground water in the WHPA. The degree of protection provided should be based on the types of potential sources located in the WHPA and the degree of risk posed by the source determined by the proximity to the well field, hydrogeologic sensitivity and type of activity. The management strategy should build on existing regulatory control programs at all levels of government. Education of owners/operators of potential contaminant sources, and voluntary adoption of best management practices (BMPs) by a given facility, are important first steps in implementing protective measures.

Phase II will consist of updates and implementation of the plan. In that, Phase II will serve to document that the activities proposed under the management strategy (Phase I) are being implemented. The plan will be evaluated every five years, as potential source management is an on-going process.

A. Management Objectives

PWSSs are expected to develop a comprehensive and coordinated management strategy on the basis of the following objectives:

1. Education Program

The management plan must include a public outreach program to educate the public and owners/operators of identified sources of contamination about the consequences of ground water contamination, and the methods available for preventing ground water contamination.

2. Existing Source Management Plan

The plan must include policies and procedures for protecting all water supply wells from identified potential sources of contamination within the WHPA. For example, potential sources could be encouraged to incorporate

waste minimization, involving some or all of the following²:

- Source reduction;
- Good housekeeping practices that reduce spill potential;
- Input material modification and product substitution;
- Technology changes and process modifications;
- Separation of hazardous and nonhazardous waste;
- Recycling, reclamation, and reuse; and
- Treatment to reduce toxicity of hazardous substances.

3. New Source Management Plan

The plan must include specific measures planned to protect all water supply wells within the WHPA from potential new sources of contamination.

4. Transportation Routes Management Plan

The management plan must include policies describing how the transportation routes will be managed in order to minimize ground water pollution through accidental spills, leakage etc.

5. Future Management Plan

The WHPA management plan must consider how the current plan will adjust to future situations associated with growth.

Each water supply, whether publicly or privately owned, is responsible for selecting and developing a series of management approaches best suited to the task of controlling potential sources of contamination within its WHPA. The process of developing

2 Further detail on pollution prevention, source reduction, and waste minimization activities for source management will be incorporated in a future source identification/management technical document.

management approaches should consider all pros and cons to wellhead protection (WHP) to facilitate selection of the best approach. Management plans should be site specific in their approach. Land use, potential sources of contamination, community characteristics, and the availability of funds and assistance are some factors to be considered.

B. Management Areas

There are two (2) management areas that need to be protected under the State's WHPP, these two areas are described as follows:

Sanitary Setback -- This is the setback area required to protect ground water from microbial contamination. In unconfined aquifers it is a 200-foot radius around the well and for confined aquifers it is a 100-foot radius around the well. These radii may be increased due to the site specific geologic environment.

WHPA -- WHPA (chemical response area) is the land surface area within, at a minimum, a five (5) year time of travel (TOT) area or within 3,000 feet from the well(s). The PWSS is required to formulate a management strategy for all pollution sources of contamination within this area. All identified sources of contamination are expected to comply with applicable State construction standards and permit requirements.

C. Management Submittal Requirements

As a portion of the overall, local wellhead protection program, all community PWSSs must initially develop a strategy for the management of all potential sources of contamination identified in the WHPA (Phase I). In addition, the PWSS must implement the strategy developed under Phase I and document where those measures have been completed or are underway (Phase II). All WHP management strategies must meet the minimum management requirements outlined below; however, these requirements do not prohibit a PWSS or community from instituting more stringent requirements.

Phase I

1. Sanitary Setback Area (100 or 200-foot radius)

Each community PWSS must develop a plan which describes the measures they will undertake to manage the Sanitary Setback area. The plan of

proposed measures must be consistent with the following requirements:

- a. This area must be managed by the PWSS consistent with the requirements for sanitary setbacks in the well construction permit. (327 IAC 8-3).
- b. Prohibit the storage or mixing of chemicals other than the following:
 - those used for drinking water treatment, or
 - pesticides which are regulated by Indiana Pesticide Review Board through IC 15-3-3.5 and IC 15-3-3.6.
- c. Secure the wellhead(s) to prevent unauthorized access (e.g., a fence or building).
- d. Provide appropriate management of existing roads within the sanitary setback (i.e., curbs, gutters, linings, etc.).

2. WHPA

Each community PWSS is required to develop a strategy proposing the measures the system (and/or community) will undertake to manage potential sources of contamination within the WHPA which addresses the following:

- a. Proposed management or monitoring measures for all potential sources of contamination, as identified by the potential source inventory. The management or monitoring measures must consider the location and type of potential pollution source, as well as the hydrogeologic characteristics of the WHPA.
- b. Compliance of PWSS production wells with state construction standards and permit requirements under 327 IAC 8-3 and 310 IAC 16.
- c. Monitoring for contaminants associated with identified potential sources of contamination according to the IDEM's standardized monitoring framework under 327 IAC 8-2.

- d. Methods or procedures for maintaining and updating records concerning changes to potential sources of contamination within the WHPA.
- e. Identification of abandoned wells not in compliance with well closure regulations administered by IDNR (IC 25-39-4-6) and 310 IAC 16-10.
- f. Use, application storage, mixing, loading, transportation and disposal of pesticides in accordance with IC 15-3-3.5, IC 15-3-3.6, and rules and guidance thereunder developed by the Pesticide Review Board and the state chemist.
- g. Provide owners and operators of identified potential sources of contamination access to a copy of the local WHP plan.
- h. Establishment of public outreach program to educate the public and owners or operators of identified potential sources of contamination about the consequences of ground water contamination, and the methods available for preventing ground water contamination (i.e., information on waste minimization, alternative management practices, etc.).
- i. Posting of Wellhead Protection signs at the perimeter of the WHPA along major thoroughfares to notify the public that they are within a WHPA.
- j. Notification of property owners, mineral owners and leaseholders of record that they are located with a WHPA.

Phase II

As a portion of the overall Phase II WHPP submittal, the PWSS must document how the management requirements (listed above) have been satisfied and exhibit implementation. In this, the Phase II submittal represents the completion of activities needed to initiate potential source management within the WHPA.

D. Management Strategy and Review Criteria

Options for controlling potential sources of contamination within the WHPA will vary depending on the PWSS therefore, the State will evaluate the appropriateness of each management strategy based on site-specific hydrogeologic, land use, and conditions of

potential sources of contamination.

The State of Indiana will consider a management strategy to be effective when:

1. The plan has local management initiatives to prevent contamination from existing, as well as future, potential sources of contamination.
2. The plan fully describes the policies and procedures for protecting all existing and proposed new water supply wells.
3. The plan considers the locations and types of sources, as well as the hydrogeologic nature of the WHPA in the selection of management approaches.
4. The plan outlines a strategy to educate the public about the consequences of ground water contamination and the methods available to prevent ground water contamination.

E. WHPP Outreach Program

Education of the public is an important part of the management program and a necessary tool in building support in the community for the local WHP plan. Hence, public awareness and understanding of the need for WHP must be promoted. The PWSS, with the cooperation of the local government, will have the ultimate responsibility of educating the local community about the consequences of ground water contamination and the methods available to prevent ground water contamination.

IDEM will initiate a public outreach effort in two parts; Part one will deal with the understanding of a proper management strategy, and Part two will address the implementation of the management strategy.

Part 1

The public will be educated about what a proper management strategy means under the State's WHPP and why it is necessary to have a comprehensive management strategy. The target audiences will be PWSS owners and operators, community leaders, business leaders and the general public. The IDEM will also involve professional organizations, such as Indiana Water and Wastewater Association, Indiana Environmental Health Association, Indiana Association of Cities and Towns, Indiana Rural Water Association, American Water Works

Association, etc., during this phase of the outreach program.

Part 2

The outreach program, during Part 2, will focus more on the details of specific management practices, public education, and the implementation of specific management goals. The IDEM will provide resources for technical/educational assistance to individual community members and also to those associated with PWSSs. Bulletins, pamphlets and fact sheets, which describe Indiana's WHPP, will be prepared and distributed to PWSS owners and operators, community leaders, business leaders and the general public. Representatives from the IDEM will organize and participate in local workshops to facilitate networking and the sharing of information. Seminars will be arranged to make presentations on the technical aspects of the program. Meetings will be scheduled so the general public is able to communicate to the IDEM types of local problems encountered during implementation of the program.

Public involvement and public education can also be accomplished through public hearings, technical advisory groups, newsletters, brochures and public service announcements. Communication promotes public trust and confidence and is a vital part of the WHPP.

F. Coordination of State and Local Authorities

The development, and subsequent implementation, of the WHPP is a coordinated effort by a number of local, State and federal agencies, with the IDEM assuming the leadership role. The WHPP will affect other program areas by influencing decisions such as remedial priorities, facility siting decisions, and design criteria for ground water protection, etc.

All existing State programs including pollution prevention, emergency response, State Cleanup, Superfund sites, etc., will be notified of approved local WHP plans. Where potential contaminant sources identified in the WHPA are regulated by a State program, the appropriate program will prioritize permit, compliance and enforcement actions for those sources. The Ground Water Section is working with existing State programs to ensure consistency among those who will be affected by a local WHP plan.

The management of a WHPA which extends over political boundaries, such as a county line, must be given equal priority. A high level of coordination between affected local governments should be undertaken. Neighboring local governments will have the responsibility to extend full cooperation to the concerned PWSS to implement an

effective management strategy. The IDEM will take part in coordination between the parties in such situations.

The area of the WHPA extending into adjacent states will be required to meet the WHP requirements of the adjacent State. The IDEM will participate and facilitate the coordination of relevant authorities in inter-State issues.

In general, the State will have the following responsibilities concerning management of the WHPA:

1. Provide source information data for regulated facilities.
2. Provide adequate management of regulated facilities consistent with design, siting, and enforcement requirements as outlined in State regulations.
3. Provide geologic Information (where available):
 - a. Well logs;
 - b. Hydrogeologic properties of aquifer(s); and
 - c. Climatic data.
4. Provide spill response information.
5. Provide technical/educational assistance:
 - a. Documents (e.g., source identification and management);
 - b. Examples of ordinances/zoning; and
 - c. Mediate negotiations between multi-jurisdictional authorities.

G. IDEM Management Plan Tracking

The IDEM will be tracking approved local plans and implementation of local management strategies. Continued tracking of management plans will begin five (5) years after the implementation of specific sites on the basis of source inventory and by information provided by individuals. Where a problem is identified, an inspector may visit the site.

The IDEM will track Phase I accomplishments by mailing two (2) surveys to each PWSS

- For large PWS systems, the first survey will be mailed two (2) years, and the second will be mailed one (1) year, prior to the

deadline for Phase I submittal;

- For medium PWS systems, the first survey will be mailed two and one half (2 ½) years, and the second survey will be mailed one (1) year, prior to the deadline for Phase I submittal; and
- For small PWS systems, the first survey will be mailed three (3) years, and the second survey will be mailed one (1) year, prior to the deadline for Phase I submittal.

The IDEM will track progress on Phase II development by sending an additional survey (which includes an update of the potential sources of contamination inventory) to each PWSS two years before the Phase II requirements must be submitted to the department as follows:

- For large PWS systems, the survey will be mailed three (3) years following IDEM approval of the Phase I submittal;
- For medium PWS systems, the survey will be mailed five (5) years following IDEM approval of the Phase I submittal; and
- For small PWS systems, the survey will be mailed eight (8) years following IDEM approval of the Phase I submittal.

To encourage continued attention to the implementation of the PWSS's management plan and potential sources of contamination inventory, the IDEM will send out a summary form to track the status of management plans. These summary forms will begin five (5) years after the approval of the Phase II WHP plan, and continue in five (5) year cycles as long as the PWSS is in operation.



VI. WHPP Contingency Plans

A. Phase I Submittal Requirements.....VI-1

B. Phase II.....VI-2

C. IDEM Responsibilities.....VI-2

VI. WHPP CONTINGENCY PLANS

A contingency plan is the most effective way of protecting the community from possible hazardous conditions involving a water supply and helps avoid possible confusion during an emergency situation. A contingency plan should outline response procedures in the event of water supply disruption due to contamination from spills or floods. As a part of the Indiana Wellhead Protection Program (WHPP), all community public water supply systems (PWSSs) must submit the minimum requirements of a complete contingency plan (as described in this section) to the IDEM for approval.

SARA Title III and the Federal SDWA require each State to coordinate with community PWSSs in the development of contingency plans for emergencies. In Indiana, coordination of PWSS contingency plans is through the Office of Water Management, Drinking Water Branch. Through these federal and State authorities, each PWSS is required to have a contingency plan in place to describe procedures in response to emergencies.

Under Indiana's WHPP, a section of the contingency plan is required to focus on response to contamination. However, if the PWSS has not developed a comprehensive contingency plan as a part of the system's WHP plan, a contingency plan for contamination events is required to be developed. If a contingency plan is in place, the following items must be included and submitted in the plan.

A. Phase I Submittal Requirements

Under the Indiana Wellhead Protection program, all PWSSs are required to prepare, maintain, and post procedures to follow in a contamination emergency and information on the location and availability of the complete contingency plan. Contents of the contingency plan submittal for Phase I must include the following:

1. A description of the system's plan to train local responders³ about their responsibilities in an emergency situation within a Wellhead Protection Area (WHPA). Minimum instructions to responders must include the following:
 - a. location of WHPA boundaries;
 - b. community members to contact in case of emergencies; and
 - c. PWSS operators to contact during an emergency.

³ Examples of the local responders who should receive the training described include local fire departments, hazmat teams, and police.

2. Twenty-four-hour telephone number service for:
 - a. IDEM, Office of Environmental Response (OER);
 - b. State, local, and city/county police;
 - c. State, local, city/county fire/hazmat team;
 - d. Local (City and/or County) disaster services agency;
 - e. Water supply owner, superintendent and operator (office and home);
 - f. City or county hospitals.
3. Identification and description of potential alternate sources of water.
4. Identification of procedures and description of methods to notify critical water users of an emergency.
5. Posting of procedures to follow in an emergency and information on the location and availability of the complete contingency plan. Emergency response to leak, spills or illegal discharges should be included.
7. Copies of the contingency plan should be kept in an easily accessible place:
 - a. One copy of the contingency plan should be kept at each water treatment plant;
 - b. One copy of the contingency plan should be kept at each water system administrator's office; and
 - c. A copy of the contingency plan should be available for inspection by State representatives.

B. Phase II

As a part of Phase II of the program submittal, community PWSSs are required to document: 1. That the training plan for local responders has been completed; and 2. The mechanism the PWSS uses for posting the completed contingency plan.

C. IDEM Responsibilities

IDEM's role and responsibilities are further defined in Section II of this document. As the Drinking Water Branch (DWB) has the responsibility for inter-agency coordination for Wellhead Protection, the DWB will keep the IDEM Office of Environmental Response

(OER) informed of approved WHPA boundaries throughout the State and emergency contacts for the PWSS system. In cases where OER responds to emergencies within a WHPA, OER will be requested to notify the emergency contact for the system and provide the DWB with a summary of the response actions which occurred in the WHPA as a result of the contamination emergency.



VII. NEW WELLS

- A. New Well Site Scenarios.....VII-1
- B. New Well Site Submittal Requirements.....VII-2
- C. Conditions of Well Site ApprovalVII-4

VII. NEW WELLS

The federal Safe Drinking Water Act (SDWA) requires that each State's wellhead protection program (WHPP) include a description of the process for siting and managing new public water supply system (PWSS) wells. To this end, Indiana is incorporating wellhead protection in the approval process of new wells and well fields to help insure proper siting. Indiana's new well siting process will include preliminary WHPA delineation and source identification in the siting for new wells. The revised well site approval procedures will be incorporated into the wellhead protection regulations as a requirement for all new well field development.

A. New Well Site Scenarios

In general there are two types of situations that require approval, these are: 1) a new well is going into an existing well field, and 2) a new well site is being developed.

1. New Well in Existing Well field

In an existing well field, a well may: (a) be located in an IDEM approved Phase I or Phase II WHP plan and the new well was included in the WHPA delineation; (b) be located in an IDEM approved Phase I WHP plan and the proposed new well is in the existing well field but was not included in the WHPA delineation of the well field and; (c) the well field is not included in an IDEM approved Phase I or Phase II WHPP.

- a. The PWSS has an approved Phase I WHP plan and the new well was included in the initial WHPA delineation either in the well placement or the pumping capacity of the well field. For these situations, the proposed new well already possesses an approved well site due to the approval of the Phase I WHP plan (i.e., well site review area is delineated and the source inventory performed). The PWSS is required to apply for a construction permit (following the guidelines in 327 IAC 8-3) and provide a description of the proposed well site and its relation to the approved WHPA. An example of this circumstance is where the PWSS has a planned future expansion of the system and incorporated the well in the WHPA delineation.
- b. A PWSS has an approved Phase I WHP plan and the proposed new well is in the existing well field but was not included in the WHPA delineation of the well field. In this case the PWSS must submit plans as a new well site and follow procedures set forth in this section for new well sites (section B, below).

- c. In the third instance, the PWSS does not have an approved Phase I WHP plan. In this case the PWSS must submit plans as a new well site and follow procedures set forth in this section for new well sites (section B, below).

2. Development of a New Well Site

In this scenario, a PWSS has proposed to develop a new well site or field where no current PWS wells exist. These are situations where a community or privately-owned water supply is expanding to a new location or creating a new public water supply system. In this case the PWSS must submit plans as a new well site and follow procedures set forth in this section for new well sites (section B, below).

B. New Well Site Submittal Requirements

Indiana's WHPP will incorporate wellhead protection into the approval process. All PWSSs proposing new wells not included in an approved Phase I WHP plan or totally new fields must receive approval for a new well and well site through the processes described below.

1. To obtain a well site approval, an applicant must submit the following information:
 - a. A United States Geological Survey (USGS) 7.5 minute series topographic map illustrating the area surrounding the well and proposed well site.
 - b. A detailed map, drawn to a scale between 1" = 400' and 1" = 1,000,' depicting:
 - Proposed well site with ownership or easement boundaries;
 - Location(s) of the proposed well(s); and
 - The sanitary setback area.
 - c. A WHPA delineated using:
 - Fixed Radius Method, with a radius of 3,000', regardless of the pumping capacity of the system;
 - An analytical, semi-analytical or numerical model, executed by a qualified ground water scientist, using input parameters calculated from regional data from published reports, or site

- specific data;
- Any approved method described in the Indiana WHPP.
- d. A potential sources of contamination inventory following the methods outlined in Section IV of this program.
- e. A summary of geologic and ground water quality information for the aquifer system utilized by a proposed well(s), where available.
- f. A schedule for the development of a Phase I WHP plan.

If a PWSS uses a fixed radius to delineate the preliminary WHPA, areas may be inventoried which have no impact on the true WHPA and exclude other areas which may have a great impact on the true WHPA. For these reasons, an analytical or semi-analytical model is recommended to delineate the preliminary WHPA. This will provide a better understanding of the potential sources within the WHPA before well construction begins and, if management of the sources appears too burdensome, a more appropriate site for the new well(s) can be sought.

2. IDEM Review

Appropriate sections of the Drinking Water Branch will review the submitted materials for completeness and accuracy of the preliminary delineation and potential sources of contamination inventory. In addition, the IDEM will field verify the site/source inventory. As part of the review IDEM will look at known sources of chemical or pathogenic contamination within the setback area of the WHPA.

The department may deny a well site if any of the following occur:

- a. A source of chemical or pathogenic contamination is found within the sanitary setback area that is so severe that it cannot be consistently treated or managed to a level considered safe by standards under 327 IAC 8-2; or

- b. A chemical or pathogenic contaminant, reported in the ground water quality information submitted with the New Well Submittal Package, is so severe that it cannot be consistently treated or managed to a level considered safe by standards under 327 IAC 8-2.

C. Conditions of Well Site Approval

Approval of a PWSS proposed well site is dependent on the ability of each PWSS to provide safe drinking water, as determined by the department. In addition, to maintain well site approval status, the PWSS must meet the following requirements:

- a. Allow no new potential sources of contamination to locate within the sanitary setback area;
- b. Operate in such a manner that it will not violate any of the sanitary or health regulations or requirements; and
- c. Maintain any additional requirements as specified by the PWSS construction permit.



VIII. Non - Community Wells

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VIII. NON-COMMUNITY PWS SYSTEMS

A. Definition

A public water system is defined as a system which has 15 or more service connections, or regularly serves at least 25 people 60 or more days a year. A system that serves water 60 or more days a year is considered to "regularly serve" water. Public water supply systems (PWSSs) can be publicly or privately owned.

PWSSs are further subdivided by regulation into two major categories: **community** and **non-community** water systems. This division is based on the type of consumer served and the frequency the consumer uses the water. In general, a **community system** serves water to a residential population, whereas a **non-community system** serves water to a non-residential population. The **non-community** category is further broken down into two categories; **non-transient, non-community** water systems and **transient non-community** water systems. The following definitions and examples further clarify the system designations:

COMMUNITY WATER SYSTEM
A public water system that pipes water for human consumption to at least 15 service connections used by year-round residents, or one that regularly serves at least 25 year-round residents (e.g., municipalities, subdivisions mobile home parks).

NON-COMMUNITY WATER SYSTEM
A public water system that pipes water for human consumption to at least 15 service connections used by individuals other than year-round residents for at least 60 days a year, or serves 25 or more people at least 60 days a year (e.g., schools, factories, rest stops, Interstate carrier conveyances).

NON-TRANSIENT, NON-COMMUNITY WATER SYSTEM
A non-community water system that serves at least 25 of the same persons over six months per year (e.g., schools, factories, industrial parks, office buildings).

TRANSIENT NON-COMMUNITY WATER SYSTEM
A non-community water system that does not meet the definition of a non-transient, non-community water system (e.g., highway rest stops, restaurants, motels, golf courses, parks).

Table VIII.1: Examples of Non-Community Water Systems

NON-COMMUNITY PUBLIC WATER SUPPLY SYSTEMS	
Non-transient	Transient
<ul style="list-style-type: none"> · Non-residential schools and institutions · Public buildings · Office buildings · Industries · Day care centers · Industrial parks <p>Anyone that employees at least 25 people.</p>	<ul style="list-style-type: none"> · Churches · Restaurants · Motels/hotels · Campgrounds · Rest areas (highway) · Parks · Service and gasoline stations · Shopping centers · Airports · Recreation areas · Marinas · Camps/clubs

B. Wellhead Protection and Non-Community PWSS

The protection of ground water quality is becoming more and more important as the costs of treatment escalates, and fewer resource areas are available to develop new supplies. The WHPP provides a logical approach for all water systems served by ground water to develop the necessary protection elements to continue providing safe and potable drinking water supplies.

The State of Indiana's overall objective in creating a State-wide Wellhead Protection program is for all PWSSs to develop and implement effective local WHP plans, including non-community systems. The federal Safe Drinking Water Act (SDWA) requires States to develop programs to protect ground water that supplies wells and wellfields that contribute drinking water to all PWSSs. However, the statutory authority for implementing wellhead protection in Indiana (IC 13-7-26-6) provides only for community water supply systems. Therefore, a PWSS which meets the criteria for designation as a non-community water supply is not required to submit a wellhead protection plan.

In order to achieve the State's overall objective of protecting all public water supplies through wellhead protection, the State will require community systems to develop local WHP plans and encourage non-community systems to voluntarily participate in the State's WHPP. Where a non-community system is proactive, and desires to formally develop

measures for wellhead protection, the State will endorse wellhead protection plans developed by non-community systems which meet the criteria for community planning, delineation, potential source identification, management, and contingency planning that are established in this program for community water supply systems.

C. Course of Action

Because the State's authority to require non-community systems to develop and implement local WHP plans is absent, the State will undertake an aggressive campaign to encourage voluntary participation by all non-community systems. The following discussion provides a description of the State's proposed efforts to affect participation by non-community systems.

1. Afford program flexibility to non-community systems to encourage greater participation:

- Optional use of the 3,000 foot radius as a default wellhead protection area (WHPA) delineation (for systems with withdrawal rates less than 100,000 gpd);
- Reduced monitoring requirements under the standardized monitoring framework in conjunction with the monitoring waiver program requirements;
- No schedule requirements for program submittal (i.e., no time frame is mandated for submittal, allowing non-community systems a longer period of time to develop programs); and
- Greater flexibility will be afforded by the State in approving proposed management measures.

2. Provide information and guidance on issues related to local programs, such as:

- Controlling non-point sources of pollution
- Suggesting land use activities for wellhead protection areas
- Developing and promulgating best management practices
- Involving county health departments to serve as an informational outlets

The IDEM will play an active role to ensure public outreach and show the benefits of having a WHP plan. Through these efforts the non-community PWSS will recognize the benefits of having a WHP plan, and gain support and cooperation for wellhead protection.

3. Provide assistance:

Wellhead Protection (WHP) Training Workshops for:

- IDEM-Drinking Water Field Inspection staff
- Public organizations
- City officials
- County health officials
- Non-community public water systems

Training workshops will further educate the key players of WHP and encourage implementation of the program. The workshops will be conducted at various sites throughout the state (i.e., to maximize attendance).

4. Provide assistance with conducting inventories of land use and potential sources of contamination in WHPAs:

- Develop and provide inventory forms or checklists
- Provide instructions on conducting inventories

An inventory of potential contaminant sources will provide opportunity to identify any past, present, and proposed activities that may be a threat to the well. By providing systems with generalized inventory forms, the source identification process will be easier to undertake, thereby minimizing staff time needed to perform the source identification.

5. Assistance with public outreach:

- Provide materials to be used at public hearings or meetings such as, videos, slide presentations, displays, brochures, or handouts;
- Invite county and city health departments to participate in local WHP meetings;
- Develop written technical assistance materials to distribute to local government and public water supply systems; and
- Respond to telephone inquiries for information on wellhead protection from local officials.

Close coordination and communication between local officials and the

public is a key element to a successful WHP plan. Public outreach has been and will continue to be an ongoing process. In addition, by providing targeted technical assistance and guidance documents which present demonstrated methods and techniques for potential source management, systems will be able to apply the management practices that suit their unique circumstances. This will maximize effectiveness and provide alternatives for systems to implement.

6. WHP questions will be integrated into:

- Sanitary Surveys (updated every 5 years w/o disinfection, 10 years w/ disinfection)
- Well site surveys
- VOC vulnerability forms
- Ground water under the direct influence of surface water determinations
- Monitoring waiver packages

Components of wellhead protection are currently being integrated into field inspections. The goal is to see the level of WHP the PWSS is currently implementing and to provide on-site guidance and encouragement to the systems. This approach is an educational tool and will help guide the systems to achieve an effective WHP plan.

7. Additional incentives for WHP include:

- Protection of ground water
- Potential for reductions in monitoring
- Protection of drinking water
- Protection of public health
- Information and guidance regarding monitoring and sampling activities specific to the needs of non-community systems.

The non-community field staff of the Drinking Water Branch along with the Wellhead Protection staff of the Ground Water Section will strongly encourage the non-community PWSS to undertake Wellhead Protection through the incentives listed above. The incentives are proposed as a means to encourage local participation which is an important component. For successful ground water protection, there must be a partnership between local governments and appropriate county and State agencies.



IX. Public Participation

- A. Summary of Public Participation Process...IX-1
- B. Implementation and Phase-In Process.....IX-2

IX. PUBLIC PARTICIPATION AND IMPLEMENTATION

A. Summary of Public Participation Process

Public input is a crucial part of developing and implementing an effective Wellhead Protection Program (WHPP). To facilitate public involvement in the development of the Indiana WHPP, the Indiana Ground Water Task Force (GWTF) formed a workgroup to provide assistance to the IDEM. This WHP workgroup consists of representatives of the water supply industry, well drillers, hydrogeologic and planning consultants, State Agencies, and industrial and commercial facility operators. The WHP workgroup has held several meetings since its inception to facilitate program development and build consensus on the numerous issues the program addresses.

Program development has been an ongoing process since 1989 and has involved public and State agency input throughout. Recent versions of the program, including the October 1993 and June 1994 drafts, were provided to IDEM Drinking Water Branch program representatives for review. In addition, these drafts were provided to members and participants of the GWTF, all mayors of Indiana cities and towns, county commissioners, one major library per county, all county health departments, all community public water supply system (PWSS) operators, and the WHP workgroup.

For each version of the program, a 30-day comment period was provided in which numerous comments were received by the IDEM. Response to comments included revisions to the draft WHPP. Following the June 1994 version, a summary of comments received and proposed revisions were developed and distributed.

Concurrently with formal submittal of the Indiana WHPP to the Regional Administrator of U.S. EPA, the State public noticed the availability of the final program in the *Indiana Register* (February 1, 1995). This public notice notified the public of the completion of the program development process and identified where copies of the program could be obtained (at the main library branch in each county of the State). The public notice provided a 30-day comment period and notice of availability for public hearing on the final program. Following the comment period, no public comments were received or any requests for public hearing on the program.

Because Indiana's Wellhead Protection program is mandatory for all community public water supply systems (CPWSS) using ground water as the source of supply, the program outlined in this document will essentially be codified in the Indiana Administrative Code (IAC). The process for promulgating a rule in the State of Indiana requires the State to hold public hearings before the Indiana Water Pollution Control Board and publish all comments on the rule in the *Indiana Register*. Therefore, Indiana's Wellhead Protection program complies with the requirements of Section 1428(b) of the federal Safe Drinking Water Act

which requires the opportunity for public hearing on the State program through this process and those described above. Copies of all comments received, including the responses published by the IDEM in the *Indiana Register* will be provided to the U.S. EPA Region 5 following publication.

The Indiana Wellhead Protection rule (327 IAC 8-4.1) final adoption was passed by the Water Pollution Control Board July 10, 1996. It is expected to become rule in January 1997.

Formal public involvement will also be a part of the WHP plan at the local level. Indiana will continue to utilize public workshops, educational seminars, the State Fair, articles, and news releases as effective public involvement and educational tools. Numerous educational seminars and workshops have been conducted by the Indiana Department of Environmental Management (IDEM) throughout the State. WHP presentations were conducted for water purveyors, regional planning groups, and professional associations during 1992 through 1995. IDEM participated in a day long teleconference to educate people about the WHPP on July 16, 1993.

B. Implementation and Phase-In Process

Development and implementation of a WHP plan requires a community to formulate specific time frames for gathering technical and land-use information. After a comprehensive plan is developed and the protection approaches have been prepared, public support must be generated for the implementation of the plan. It is critical that local residents are kept informed of the progress during program development to ensure support by all sectors.

The following Phase-in guidelines will be maintained by the State throughout the WHPP implementation process:

Fiscal Year 1996:

- Initiate the development of Technical Assistance and Public Educational Documents;
- Obtain formal approval of the Indiana WHPP by U.S. EPA, Region 5;
- Promulgate regulations for wellhead protection through the rule adoption process of the Indiana Water Pollution Control Board (IWPCB);
- Develop WHP application forms;

- Complete a survey of community and non-community PWSSs, to determine the level of knowledge and understanding of the program and the specific information needs and concerns of the systems with respect to WHP;
- Review new well-site applications;
- Initiate educational outreach program to the public and PWSSs.

Fiscal Year 1997:

- Finalize plans for obtaining full staff at the State level for the comprehensive WHPP;
- Finalize Technical Assistance and Public Educational documents;
- Review applications for WHP plans;
- Develop and finalize a computerized monitoring program to track the submittal and approval of WHP plans;
- Track compliance of the WHP plans through inspections and reporting requirements.

APPENDIX I

REFERENCES

HNTB; November, 1993, U.S. EPA *Wellhead Demonstration Project, Speedway, Indiana - Final Report*; HNTB, Indianapolis, IN #11504-PL-035.

Ohio Environmental Protection Agency; August, 1994, *Ohio Wellhead Protection Program's, Wellhead Protection Area Delineation Guidance, Interim Report*, Ohio EPA-DDAGW, Columbus, Ohio.

U.S. Environmental Protection Agency; December, 1991, *Guide For Conducting Contaminant Source Inventories for Public Drinking Water Supplies, Technical Assistance Document*; Office of Ground-Water Protection, Washington, D.C., EPA 570/9-91-014.

U.S. Environmental Protection Agency; June, 1987, *Guidelines for Delineation of Wellhead Protection Areas*, Office of Ground-Water Protection, Washington, D.C., EPA 440/6-87- 010.

U. S. Environmental Protection Agency; April, 1989, *Wellhead Protection Programs: Tools for Local Governments*; Office of Ground-Water Protection, Washington, D.C., EPA 440/6-89-002.

APPENDIX II

Items to be Considered During Selection of Delineation Method (After OEPA, 1994, Wellhead Protection Area Delineation Guidance.)

Hydrogeologic Setting

1. **Aquifer material** - This addresses the type of material the water is drawn from, if it is consolidated or unconsolidated. If it is unconsolidated, is it sand, gravel or sand and gravel? If it is consolidated, is it limestone, fractured limestone or sandstone?
2. **Hydraulic properties** - The size of a well's capture zone is affected by the hydraulic properties of the aquifer. These include hydraulic conductivity, porosity and transmissivity. These properties are intrinsic to the aquifer material and do not vary significantly with time. Hydraulic conductivity is one of the most important determinants of flow velocity.
3. **Aquifer confinement conditions** - Aquifers can be confined, unconfined or semi-confined. This information is important to assess the aquifer's vulnerability to contamination. By assessing the aquifer's vulnerability to contamination, the need for accuracy of delineation can also be addressed. If the PWSS cannot provide for the desired degree of accuracy, the WHPA can be expanded by using a TOT of greater than five years. Most models also require confinement conditions be defined as an input parameter.
4. **Flow boundaries** - Ground water flow boundaries can affect the size and orientation of a capture zone significantly and many of the widely used computer flow models require knowledge of their location and orientation.
5. **Local flow gradients and directions** - Local flow gradients and directions may have the most significant effect on the size, shape and orientation of a capture zone. For example, flow boundaries may include, a bedrock valley wall, surface water bodies, and ground water flow divides.

Management Plans

1. **Current and anticipated size of system** - The size of the system needs to be considered when selecting the appropriate delineation method. The more people served by the system, the greater the population at risk if the delineation area is significantly inaccurate. A large system pumping more water at a greater rate will have a larger capture zone around the well field than a smaller water system.

2. **WHP goals and management strategies** - PWSS and communities should explore the most feasible management options available even before delineating the well field, as this may aid in the choice of a delineation method. For example, those systems considering zoning restrictions or land purchases may desire a highly accurate delineation to avoid restricting a greater area than necessary. While the costs of a more accurate delineation may be high, applying management options to the wrong area, or an area much larger than necessary, could be more expensive in the long run.
3. **Defensibility of chosen method** - An advanced delineation method may be desirable if the accuracy of the delineated area will be challenged. This may occur when the WHPA extends into other political jurisdictions or if the management strategies include zoning restrictions.
4. **Well field geometry** - The spatial relationship between the existing wells or planned wells is important when pumping interference needs to be considered. Not all models take this factor into account.
5. **Nearby pumping centers** - Nearby pumping centers can distort the shape of the WHPA by acting as a barrier to ground water flow. Such pumping centers may include industrial wells, other public water supply wells, and agricultural wells. It is important to know where these pumping centers are located in relation to the well field and to use a method that can model multiple wells if the nearby pumping centers appear close enough to influence the WHPA.

APPENDIX III

ABBREVIATIONS and ACRONYMS

BMP - Best Management Practices

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

CERCLIS - Comprehensive Environmental Response, Compensation and Liability Information System

CES - Cooperative Extension Service

CPWSS - Community Public Water Supply System

DOC - Department of Commerce

DWB -Drinking Water Branch

EPA - Environmental Protection Agency

GPD - Gallons Per Day

GPS - Global Positioning System

GWTF - Ground Water Task Force

IAC - Indiana Administrative Code

IC - Indiana Code

IDEM - Indiana Department of Environmental Management

IDNR - Indiana Department of Natural Resources

INDOT - Indiana Department of Transportation

ISDH - Indiana State Department of Health

IURC - Indiana Utility Regulatory Commission

IWPCB - Indiana Water Pollution Control Board

LUST -	Leaking Underground Storage Tank
MACOG -	Michiana Area Council of Government
NIRPC -	Northwest Indiana Regional Planning Commission
NPDES -	National Pollutant Discharge Elimination System
NPL -	National Priority List
OER -	Office of Environmental Response (IDEM)
OISC -	Office of the Indiana State Chemist
OKI -	Ohio - Kentucky - Indiana Regional Council of Governments
OPPTA -	Office of Pollution Prevention and Technical Assistance (IDEM)
ORSANCO -	Ohio River Basin Sanitation Commission Service
OSFM -	Office of the State Fire Marshall
OSHWM -	Office of Solid and Hazardous Waste Management (IDEM)
PWS -	Public Water System
PWSS -	Public Water Supply System
PWSSs -	Public Water Supply Systems
RCRA -	Resource Conservation and Recovery Act
SARA -	Superfund Amendments and Reauthorization Act
SWDA -	Safe Drinking Water Act
TOT -	Time of travel
USDA -	United States Department of Agriculture

USDA-NRCS -United States Department of Agriculture - Natural Resources Conservation Service

USGS - United States Geological Survey

UST - Underground Storage Tank

WHP -Wellhead Protection

WHPA - Wellhead Protection Area

WHPP - Wellhead Protection Program

APPENDIX IV

Arbitrary Fixed Radius Summary Report

I. Introduction

The 1986 amendments to the federal Safe Drinking Water Act require states to formally protect ground water which supplies public water systems. Section 1428 of the SDWA requires States to develop plans which describe, among other things, determination of wellhead protection areas (WHPAs) for each public well or wellfield. The methods for delineating a wellhead protection area (WHPA) were selected by the IDEM (in conjunction with the Wellhead Workgroup) based on ease of use and understanding, economy of development and implementation, ability of method to account for local geology, and technical defensibility. Five methods were endorsed by the IDEM and the Wellhead Workgroup for delineation of a WHPA; 1.) Fixed Radius 2.) Analytical 3.) Semi-analytical, 4.) Numerical flow/solute transport, and 5.) Hydrogeologic mapping.

The fixed radius method of defining a WHPA is obtained by applying a circle with a defined radius and the center at the well. The radius is intended to approximate the distance of a 5-yr TOT. The IDEM initially proposed a 4,500 ft. radius in the program. After further evaluation and discussion with the Wellhead Workgroup, a 3,000' radius was selected. The purpose of this report is to: 1) provide the rationale for the use of a fixed radius method in Indiana, 2) document the process and methods used to determine the representative radius, 3) give examples of where the fixed radius method may not be appropriate and 4) discuss how IDEM review Wellhead Protection Programs (WHPP) submitted using fixed radius to define the WHPA.

II. Rationale for Fixed Radius in Indiana

In Indiana, the fixed radius method is allowed to be used by small systems. In preliminary modeling of WHPAs with high transmissivities it was found capture zones are represented as a narrow strip of land extending toward the source area (Fig. 1) (Mohammed Iqbal, verbal communication, 1994). This narrow strip is probably only a part of the true WHPA, which is probably larger due to transient flow dynamics in the system. The cost of gathering data to determine the direction and value of the transient flow, the cost of modeling a dynamic system, and the financial resources of small systems are the rationale for allowing systems to use a fixed radius.

To limit the use of fixed radius method to smaller systems only, the fixed radius method was endorsed for use by PWSSs which qualify as a non-significant water withdrawal facility as defined by IN 13-2-2.5. A nonsignificant ground water withdrawal facility means the ground water withdrawal facility of a person that, in the aggregate, has a withdrawal capability of less than one hundred thousand (100,000) gallons of ground water in one day.

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III. Fixed Radius WHPA vs. True WHPA

The shape of a WHPA delineated by fixed radius method is, by definition, a circle around a well, while the shape of a WHPA delineated by an analytical, semi-analytical or numerical method is usually an elongated ellipse. (Fig. 2). It can be seen in Fig 2 that, if a fixed radius method is used, a much larger WHPA maybe delineated and management practices must be applied to areas which may not be included in a WHPA delineated using another method. In choosing a delineation method it is important to consider: 1) the goals of the management strategy as chosen by the local planning team, 2) the cost incurred by applying the management plans over areas which may not be in the WHPA and 3) the cost of delineating by other methods.

V Determination of radius

A. First Modeling Efforts

1. Goal

The goal of the IDEM's first modeling effort was to calculate the distance of a 5-yr. TOT using transmissivities which represent the extreme values found throughout Indiana. In this manner, the fixed radius would include all hydrogeologic settings in the state and could be used with no review necessary by the IDEM. In addition, the effect of varying the value of transmissivity and the pumping rate on the capture zone was qualitatively evaluated.

2. Model and Parameters

The first model effort employed WHPA's, GPTRAC (Blandford and Huyakorn)1 module. WHPA/GPTRAC is a semi-analytical method with a time-related capture zone delineation for simple cases using analytical velocity computation techniques. WHPA/GPTRAC assumes a steady state system with 2-dimensional flow and a homogeneous, isotropic aquifer. Input parameters not varied in model runs are listed in Table 1. Variations of T and Q, with resultant distance of 5-yr. TOT are listed in Table 2.

Table 1. Fixed Parameters of Initial Model	
Parameter Type	Parameter Value
Aquifer type	confined
Thickness	100 ft.
Porosity	.25
Gradient	.005

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Table 2. Values of Transmissivity and Pumping Rates with Resultant Distance of 5-yr. TOT		
Transmissivity (gpd/ft)	Pumping Rate (gpd)	5-year TOT Distance (feet)
100,000	100,000	4,500
100,000	80,000	4,500
100,000	60,000	4,500
100,000	40,000	4,500
100,000	20,000	4,500
50,000	100,000	2,800
50,000	80,000	2,800
50,000	60,000	2,800
50,000	40,000	2,800
50,000	20,000	2,800
20,000	100,000	2,200
20,000	50,000	2,200
20,000	20,000	2,200

3. Results

Based on the assumption that the WHPA delineated using fixed radius should cover hydrogeologic scenarios with the highest transmissivity values found in the state, a radius of 4,500 feet was proposed and presented in the June 1994 draft of the Indiana WHPP. With a radius of 4,500 feet, any PWSS being a non-significant water user as defined by IC 13-2-2.5-2(1) could use the fixed radius method with no review from the department.

4. Sensitivity Analysis

A formal sensitivity analysis was not performed on the initial model but, in reviewing Table 2, it can be seen that, in general, increasing the transmissivity value increases the distance of the WHPA, while increasing the discharge of the simulated pumping well increases the width of the WHPA.

B. Reevaluation of 4,500' radius

The fixed radius distance of 4,500 feet was incorporated in the June, 1994 draft of the Indiana Wellhead Protection Plan and provided to the wellhead workgroup. Numerous comments in response to this draft, and in particular, the 4,500 foot radius, were received by the IDEM. Many comments indicated the 4,500' radius was too large and would not apply to the majority of systems in Indiana. That is, most of systems in Indiana do not have high transmissivity values and therefore would not need such a large fixed radius. Based upon these comments, the IDEM began to reevaluate the 4,500 foot radius.

C. Second Modeling EffortC. Second Modeling Effort

1. Goal. Goal

The goal of the second modeling effort was to determine a radius which would include the majority of hydrogeologic scenarios in the state. That is the radius determined should be equal to or greater than the distance of a 5-yr. TOT if calculated by the majority of PWSSs in the state.

2. Modeling. Modeling

The modeling employed two types of models; WHPA/GPTRAC and MODFLOW/MODPATH (McDonald and Harbaugh, 1988)2. WHPA/GPTRAC was previously discussed in the summary of the first modeling efforts. MODFLOW is a numerical simulation which derives the distribution of hydraulic head across a model grid, or water table elevations. The ground water table data is passed to MODPATH which tracks particles backward in time to delineate the WHPA.

3. Modeling Parameters. Modeling Parameters

Based on the goal set forth for the second modeling effort and considering the first modeling effort's informal sensitivity analysis findings, the average value of transmissivity for unconsolidated aquifers was investigated. IDEM choose to also determine the average hydraulic gradient throughout the state. Parameter values used to calculate the 3,000' radius are presented in Table 4.

a. Investigation of Transmissivity Values and Hydraulic Gradientsa. Investigation of Transmissivity Values and Hydraulic Gradients

IDEM conducted a review of transmissivity values and hydraulic gradients found in published reports. This review was not exhaustive, but consisted of publications which were readily available.

For transmissivity, if a range was reported, a modal value was calculated; if an average value was reported, that average value was used. The transmissivity values are listed in Table 3 and compared in fig. 3. From the compiled data of transmissivity values, a value of 20,000 ft²/d for transmissivity was determined to be the median value and used as the transmissivity value in the second modeling effort. For hydraulic gradient, if a average value was reported, that value was used, if only a map of hydraulic head across the reported area was reported, a average gradient was measured off the map. These average values are reported in Table 3. A average value for .001 was calculated.

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Table 3. Reported Values of Transmissivity and Hydraulic Gradient			
Reporting Region	Transmissivity (gpd/ft)	Transmissivity (ft ² /d)	Hydraulic Gradient
Upper Wabash Basin (Tate, Et al, 1973) ³	175,000	23,000	.001
Maumee Basin (Pettijohn and Davis, 1973) ⁴	150,000	20,000	.003
Madison (Laphan, 1981) ⁵	190,000	21,000	.001
Hamilton & Tipton (Airhood, 1982) ⁴	100,000	11,000	.001
Delaware & Henry (Airhood and others, 1982) ⁷	190,000	22,000	.002
Porter & LaPorte Co (Rosenshein and Hunn, 1968) ⁸	85,000	10,000	.001
Marion Co (Meyer and others, 1975) ⁹	100,000	12,000	.002
Waterwater Basin (IDNR, 1988) ¹⁰	100,000	10,000	.001
Kankakee Basin (IDNR, 1987) ¹¹	255,000	29,000	.001
St. Joe Basin (IDNR, 1987) ¹²	350,000	40,000	.002
Elkhart Co (Duwelius and Silcox, 1991) ¹³	176,000	20,000	.001

b. Aquifer Thickness (b) - the value of 50 feet was chosen as the simulated thickness of the aquifer, and is different from 100 foot value used in the first modeling effort. The thickness of the aquifer was changed due to the fact that the models used assume full penetration of the well throughout the simulated aquifer and generally, small PWSSs have a maximum screened interval of 20 feet. Therefore, the 50 feet of aquifer simulated is the portion of the aquifer affected by pumping. A change to 50' thickness is a conservative choice; as the thickness of the aquifer becomes greater, the distance of the TOT also becomes greater.

c. Hydraulic Conductivity (k) - the hydraulic conductivity value was calculated from transmissivity values by the equation: $k = T/b$ to be 400 ft/d.

d. Aquifer Type - The aquifer was treated as unconfined. The aquifer type was changed from the first modeling effort because it was assumed that the majority of hydrogeologic systems throughout the state with high transmissivity values do not have a continuous confining layer and are unconsolidated aquifers .

e. Pumping Rate - The pumping rate for the simulated well was 11,337 ft³/d (100,000 gpd). This value is the maximum pumping rate allowed for use with the fixed radius method. The sensitivity to the pumping rate was examined informally in the first modeling effort and it was determined that changes in the pumping rate, in general, do not change the total distance of the 5-yr TOT but, instead changes the width of the of the delineated WHPA.

f. Porosity - The porosity value of .25 was used in the second modeling effort, as it was in the first.

Table 4. Parameters and Resultant TOT in Second Modeling Effort	
Aquifer type	unconfined
Pumping Rate	11337 ft ³
Porosity	.25
Transmissivity	20,000 ft ² /d
Hydraulic Gradient	.001
5-yr TOT (GPTRAC)	3,000 ft
5-yr TOT (MODFLOW/MODPATH)	3,200 ft

4. Model assumptions

All simulations in the second modeling effort assumed steady state conditions with isotropic, homogeneous conditions and two-dimensional flow.

5. Findings . Findings

As shown in table 4 the 5-yr TOT was calculated as 3,000' by WHPA/GPTRAC and 3,200' by MODFLOW/MODPATH. Based on these finding IDEM presented a 3,000 ft radius for the fixed radius method to the Wellhead Workgroup. The 3,000' radius was endorsed by the Wellhead Workgroup and included in the February, 1995 draft of the Indiana Wellhead Protection Plan.

6. Model Sensitivity

A qualitative sensitivity analysis of the model to variations in parameter values was performed. In the

second modeling effort, sensitivity to changes in porosity and hydraulic gradient and how these changes affect the 5-YR TOT distance, the criterion for selecting the fixed radius distance, were examined. Changes in transmissivity and pumping rate were informally examined in the first modeling effort. Results of the sensitivity analysis in the second modeling effort are presented in Table 5.

Porosity - Changes to porosity were examined with the WHPA/GPTRAC model by changing the value of porosity and keeping the remaining values constant. Porosity value were changed from .25 to .28 and .30, increasing the 5-yr TOT distance and by 200' and 500' respectively (Table 4). Based on these findings, the model was found to be somewhat sensitive to changes in porosity .

Hydraulic gradient - The effect of changes to hydraulic gradient were examined with WHPA/GPTRAC model by varying the value from .001 to .002 and .005 and keeping the other values constant.. The 5-yr TOT responded dramatically to changes to hydraulic gradient; increasing the hydraulic gradient from .001 to .002 caused the TOT to increase by 2,200 feet (table 5). Based on this analysis, the model appeared quite sensitive to changes in hydraulic gradient.

Table 5. Sensitivity Analysis of 5-YR TOT Distance for Second Modeling Effort.				
Model	Transmissivity (ft ² /d)	Gradient	Porosity	Distance
GPTRAC	20,000	.002	.28	5,200
GPTRAC	20,000	.005	.28	10,000
GPTRAC	20,000	.001	.28	2,800
GPTRAC	20,000	.001	.30	2,300

V. Fixed Radius Applicability - The goal of the second modeling effort was to determine a radius which would adequately cover the distance of the 5-yr TOT for the majority of hydrogeologic scenarios in the state. This goal was used as the criterion for choosing transmissivity and hydraulic gradient values for input into the model. A concern with using this goal is that some hydrogeologic systems are above the majority and will have a 5-yr TOT greater than 3,000'. For these systems a 3,000' radius may leave a portion of the 5-yr. TOT unprotected by management practices implemented in the WHPP.

There are complex interactions among all hydraulic parameters when calculating the 5-yr TOT distance. Therefore, the IDEM identified the parameters which have the greatest effect on the distance of the 5-yr TOT. To identify these parameters the sensitivity analysis performed in the first and second modeling efforts was reviewed. In the first modeling effort sensitivity analysis it was determined that systems with transmissivities greater than 20,000 ft/d may increase the 5-yr TOT to a distance greater than 3,000' (Table. 2). In the second modeling effort it was determined that input of a hydraulic gradient greater than .001 is likely to produce a 5-yr TOT greater than 3,000 ft. Therefore, if a PWSS is pumping from a hydrogeologic system with a hydraulic gradient greater than .001, or transmissivity much greater than

20,000 ft²/d, a 3000' radius may be too small for that system and the use of the fixed radius method may not be appropriate. In these cases, after review of available data, IDEM may require the PWSS to use another approved method to delineate the WHPA.

VI. Review Criteria for Fixed Radius method

In reviewing a WHPA which has used a fixed radius method the IDEM will estimate if the PWSS has hydraulic parameters which fall above or below the average parameters which have been used to calculate the 3000' radius. For example, is the transmissivity for the area of the PWSS much greater than 20,000 ft²/d? To determine the hydrogeologic parameter values IDEM may examine or use tools such as:

1. The pumping history of the PWSS;
2. Published reports of the area in which the PWSS is located;
3. Unpublished reports and files held at the IDEM (e.g., maps and descriptions of hydrogeologic settings in Indiana as prepared by the Indiana Geological Survey;
4. The written justification submitted with the WHPA; or
5. Analytical or Semi-Analytical Modeling.

VII. Submittal Requirements for Fixed Radius Delineation

Systems which do use the fixed radius will have significantly less submittal requirements compared to systems which delineate with other methods. A PWSS that delineates the WHPA using the Fixed Radius Method must submit the following data to the department:

1. A map depicting the following:
 - a. The wellhead protection area boundary;
 - b. The PWSS pumping well(s); and
 - c. Other pumping sources in the area.
2. A topographic map of the area
3. Well logs of the PWSS pumping well(s).

VIII. Conclusions

The methods for delineating WHPA were selected based on: 1) ease of use and understanding, 2) economy of development and implementation, 3) ability of method to account for local geology and 4) technical defensibility. Because of the cost of modeling and the uncertainty of WHPA boundaries in possible transient situations, the IDEM and the Wellhead Workgroup endorsed the use of the fixed radius method for systems defined as a non-significant water users by IC 13-2-2.5. Based on modeling efforts, initially the IDEM proposed a 4,500' radius to delineate a 5-yr TOT for all hydrogeologic setting in Indiana. Any PWSS being a non-significant water user could delineate using the 4,500' radius with no review necessary by IDEM. After receiving numerous comments suggesting that most system in Indiana would not need such a large radius to delineate the WHPA, IDEM reevaluated the 4,500' radius.

Based on modeling efforts simulated an unconfined aquifer and using a porosity of .25, transmissivity of 20,000 ft²/d, and a hydraulic gradient of .001, the IDEM concluded that a 3,000' fixed radius will delineate a 5-yr TOT which accounts for the majority of hydrogeological systems in Indiana. The fixed radius method with a 3,000' radius is available to any PWSS being a non-significant water. The IDEM will review the WHPP submittal to determine if the parameters in the area of the PWSS are greater than those used to calculate the 3000' radius. If the parameters are greater than those used to calculate the 3000' radius and it is deemed by the IDEM that the 5-yr TOT would be greater than 3,000', the IDEM may require that the PWSS utilize another method to delineate the WHPA.

REFERENCES CITED

INDIANA WELLHEAD PROTECTION RULE

327 IAC 8-4.1

INDIANA WELLHEAD PROTECTION RULE

327 IAC 8-4.1

Rule 4.1. Wellhead Protection

327 IAC 8-4.1-1 Definitions

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18; IC 13-11-2-43; IC 15-3-3.5; IC 15-3-3.6; IC 25-39-4

Sec. 1. In addition to the definition in IC 13-11-2-43, the following definitions apply throughout this rule:

- (1) "Aquifer" means an underground geological formation that has the ability to receive, store, and transmit water in amounts sufficient for the satisfaction of any beneficial use.
- (2) "Best management practices" means schedules of activities, prohibitions of practice, treatment requirements, operation and maintenance procedures, use of containment facilities, and other management practices to prevent or reduce the pollution of waters of the state.
- (3) "Calibration" means the process of refining the model representation of the hydrogeologic framework, hydraulic properties, and boundary conditions to achieve a desired degree of correspondence between the model simulation and observations of the ground water flow system.
- (4) "Certified Professional Geologist" means a professional geologist certified by the state of Indiana under IC 25-17.5-1.
- (5) "Community public water supply system" or "CPWSS" means a public water supply system that serves at least fifteen (15) service connections used by year-round residents or regularly serves at least twenty-five (25) year-round residents.
- (6) "Conceptual model" means a description of the hydrogeologic system that represents the movement of ground water, for example:
 - (A) geologic and hydrologic framework;
 - (B) media type;
 - (C) physical processes;
 - (D) hydraulic properties; and
 - (E) water budget.
- (7) "Confined aquifer" means an aquifer in which ground water is confined under pressure that is significantly greater than atmospheric pressure.
- (8) "Critical water users" means water users whose immediate health or welfare would be affected in an adverse manner if water use is denied.
- (9) "Customers" means number of persons served by the public water supply system.
- (10) "Delineation" means a process used to define boundaries of the well head protection area.
- (11) "Department" means the department of environmental management created under IC 13-13-2.
- (12) "Emergency condition" means a condition related to ground water contamination which threatens to disrupt water supply service from a community public water supply system wellfield.

- (13) "Hydrogeology" means the study of the geology of ground water, with particular emphasis on the chemistry and movement of water.
- (14) "Hydrostratigraphic unit" means a grouping of geologic units of similar hydrogeologic properties, for example, aquifers and confining units.
- (15) "Large public water supply system" means a public water supply system serving greater than fifty thousand (50,000) customers.
- (16) "Medium public water supply system" means a public water supply system serving from three thousand three hundred one (3,301), up to and including, fifty thousand (50,000) customers.
- (17) "Model" means an investigative technique using a mathematical or physical representation of a system or theory that accounts for all or some of its known properties.
- (18) "Pesticide review board" means the Indiana pesticide review board created by IC 15-3-3.5 to collect, analyze, and interpret information on matters relating to the use of pesticides.
- (19) "Potential source of contamination" means a facility, site, practice, or activity that possesses the ability to contaminate ground water.
- (20) "Public water supply system" or "PWSS" means a public water supply for the provision to the public of piped water for human consumption if such a system has at least fifteen (15) service connections or regularly serves an average of at least twenty-five (25) individuals daily at least sixty (60) days out of the year.
- (21) "Qualified ground water scientist" means an individual who possesses a bachelor's degree or higher in the physical sciences, for example geology, or engineering with a sufficient level of experience to make sound professional judgments regarding site characterization and hydrogeology. This level of experience may be demonstrated by certification or registration as a professional geologist or engineer, either of whom shall have education or professional experience in hydrogeology or ground water hydrology.
- (22) "Sanitary setback" means an area established around a CPWSS production well to protect ground water from direct contamination.
- (23) "Small public water supply system" means a public water supply system serving up to and including three thousand three hundred (3,300) customers.
- (24) "State chemist" means the office of the Indiana state chemist authorized by IC 15-3-3.5 and IC 15-3-3.6 to administer the use, application, storage, mixing, loading, transportation, and disposal of pesticides in Indiana under those chapters.
- (25) "Time of travel" or "TOT" means the calculated length of time a particle of water takes to reach a CPWSS production well from a certain point.
- (26)"Time of travel (TOT) threshold" means a threshold determined by the community or CPWSS to suit the hydrogeologic conditions and needs of the community; however, a minimum five (5) year TOT for modeled wellhead protection areas and three thousand (3,000) feet for fixed radius wellhead protection area is allowed.
- (27) "Wellhead protection area" or "WHPA" means the surface and subsurface area, delineated by fixed radius, hydrogeological mapping, analytical, semianalytical, or numerical flow/solute transport methods, which contributes water to a CPWSS production well or wellfield and through which contaminants are likely to move through and reach the well within a specified period.
- (28) "Wellhead protection program" or "WHPP" means a program to sustain drinking water quality in ground waters that supply public water supply wells and wellfields. The program is mandated by the 1986 amendments to the Federal Safe Drinking Water Act, Title II, Section 205, Subsection 1428.

(28) "Well log" means a drilling record that describes the subsurface formations that have been drilled through and gives details of well completion as required by IC 25-39-4 and 310 IAC 16-2-6. (Water Pollution Control Board; 327 IAC 8-4.1-1)

327 IAC 8-4.1-2 Applicability of rule

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 2. The WHPP is required for each well or wellfield providing ground water to a CPWSS. (Water Pollution Control Board; 327 IAC 8-4.1-2)

327 IAC 8-4.1-3 Enforcement

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-30-3; IC 13-14-12; IC 13-30-4; IC 13-30-6

Sec. 3. This rule may be enforced through administrative or judicial proceedings, under IC 13-30-3 and the penalty provisions of IC 13-14-2; IC 13-30-4; IC 13-30-6. (Water Pollution Control Board; 327 IAC 8-4.1-3)

327 IAC 8-4.1-4 Local planning teams

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 4. (a) The CPWSS shall coordinate and form or participate in a local planning team (LPT) to guide the development and implementation of the CPWSS's WHPP.

(b) The local planning team must have representation of parties that may be affected by the development and implementation of the WHPP.

(c) The CPWSS must public notice the formation of a local planning team in the newspaper of largest general circulation within the area where the LPT is being formed.

(Water Pollution Control Board; 327 IAC 8-4.1-4)

327 IAC 8-4.1-5 Criteria for selecting the delineation method for determining the wellhead protection area

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18; IC 14-25-7

Sec. 5. (a) During Phase I of the WHPP, the CPWSS must delineate the WHPA using one (1) of the five (5) accepted methods of delineation.

(b) Any CPWSS may use the following methods:

(1) The analytical method.

(2) The numerical flow/solute transport model methods.

(3) The semianalytical method.

(c) A CPWSS may use the hydrogeologic mapping method as the sole method of delineation only with prior approval from the department.

(d) A CPWSS may use the fixed radius method after receiving prior approval from the department. Approval to use the fixed radius method is based on either of the following criteria:

(1) A CPWSS does not qualify as a significant water withdrawal facility (in accordance with IC 14-25-7).

(2) A CPWSS qualifies as a significant water withdrawal facility, in accordance with IC 14-25-7, and the average daily withdrawal is less than one hundred thousand (100,000) gallons per day demonstrated by:

(A) submittal of annual total pumping data for the previous five (5) years of operation to the department; and

(B) statistical determination by the department of an upper confidence interval of one hundred thousand (100,000) gallons per day or less by the following formula:

$$\bar{x} = t_{(0.95, n-1)}(S/n^{1/2})$$

\bar{x} = Mean of pumping data

S = Standard deviation of pumping data

$t_{(0.95, n-1)}$ = t statistic at 95%, n degrees of freedom

n = Number of observations

(e) Upon selecting and carrying out a delineation method, a CPWSS must submit justifying data in accordance with section 8 of this rule.

(f) All delineation methods available to CPWSSs for defining the WHPA are outlined within "Guidelines for Delineation of Wellhead Protection Areas" . *

(g) Site characterization and WHPA delineation, using either the modeling methods, described in subsection (b), or hydrogeological mapping methods described in subsection (c), must be performed by a qualified ground water scientist.

(Water Pollution Control Board; 327 IAC 8-4.1-5)

* "Guidelines for Delineation of Wellhead Protection Areas", United States Environmental Protection Agency, Office of Ground Water Protection, Washington, D.C. 20460, May 1993, EPA Publication No. 440/5-93-001. Copies of "Guidelines for Delineation of Wellhead Protection Areas" are available at the Indiana Department of Environmental Management, Office of Water Management, Drinking Water Branch, Ground Water Section, 100 North Senate Avenue, P.O. Box 6015, Indianapolis, IN 46206-6015.

327 IAC 8-4.1-6 Map requirements

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 6. (a) All maps required by this rule, except topographic maps, must be drawn to a scale between 1" = 400' and 1" = 1,000'.

(b) All topographic maps required by this rule must be United States Geological Survey (USGS) seven and one-half (7.5) minute series.

(Water Pollution Control Board 327 IAC 8-4.1-6)

327 IAC 8-4.1-7 Delineation

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 7. (a) If a CPWSS delineates the WHPA using a model, a report with a narrative description of the regional hydrogeologic setting, the conceptual model, and modeling efforts must be submitted. The report must include the following:

- (1) Analysis of hydrogeologic setting and the conceptual model including the following:
 - (A) Map of the area of interest.
 - (B) Review of published hydrogeologic and geologic interpretations over the area of interest.
 - (C) Geologic cross sections showing the following:
 - (i) Hydrostratigraphic units.
 - (ii) Water levels.
 - (iii) Relationship of surface water bodies to the hydrostratigraphic units.
 - (iv) Pumping wells with screened intervals.
 - (D) Well logs and records used in cross section development. If the number of well logs used in cross section development is greater than fifty (50), the maximum number of well logs submitted to represent the cross section(s) may be negotiated with the department.
 - (E) A map that illustrates over the area of interest the following:
 - (i) Location of CPWSS wells.
 - (ii) Location of high capacity wells registered as significant water withdrawal facilities as defined in IC 14-25-7.
 - (iii) Surface water features.
 - (iv) Thickness and extent of hydrostratigraphic units.
 - (v) Regional water levels.
 - (vi) Bedrock topography.
 - (F) Summary of raw data used in the development of the conceptual model.
 - (G) Discussion of hydrogeologic parameters.
 - (H) Discussion of the ground water flow system including the following:
 - (i) Distribution of recharge.
 - (ii) Current CPWSS pumping rates and planned changes in pumping rates.
 - (iii) Pumping rates of neighboring high capacity wells.
- (2) Presentation and discussion of the modeling effort must include the following:
 - (A) The rationale for delineation method selection.
 - (B) A tabulated summary of the model input parameters showing the range over which the parameters

were varied.

(C) An example input file.

(D) A map showing the following:

- (i) The domain of the modeled area within the area of interest.
- (ii) Location of any boundary conditions used.
- (iii) Calibration target locations if used.
- (iv) Modeled potentiometric surfaces.
- (v) Resultant WHPA boundaries.

(E) Discussion of the following:

- (i) Assumptions used in the modeling effort.
- (ii) Changes made to initial conditions.
- (iii) Calibration analysis if used.
- (iv) Water budget of the model if available.
- (v) Effects of uncertainty in input parameters and boundary conditions on modeled WHPA boundaries.

(b) A CPWSS that, after approval from the department, delineates the WHPA using the fixed radius method must submit the following data to the department:

(1) A map depicting the following:

- (A) The wellhead protection area boundary.
- (B) The CPWSS pumping well locations.
- (C) The location of wells in the area registered as significant water withdrawal facilities as defined in IC 14-25-7.

(2) A topographic map of the area.

(3) Well logs for the CPWSS pumping well.

(c) A CPWSS that delineates the WHPA using the hydrogeologic mapping method must submit data as required and agreed to by the department and the CPWSS.

(Water Pollution Control Board; 327 IAC 8-4.1-7)

327 IAC 8-4.1-8 Phase I submittal requirements

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 9-21-2; IC 9-21-3; IC 13-11; IC 13-13; IC 13-18; IC 15-3-3.5; IC 15-3- 3.6; IC 25-31; IC 25-39-4-6

Sec. 8. To have Phase I of a WHPP approved by the department, a CPWSS must submit the following material as prescribed in section 15 of this rule:

- (1) The names and affiliations of the members of the local planning team, as well as any subcommittees designated by the local planning team.
- (2) A complete WHPA delineation as described in section 7 of this rule. Items submitted in compliance with section 7(a)(1)(C), section 7(a)(1)(E)(iv), section 7(a)(1)(E)(vi) and section 7(c) must be performed by or under the supervision of a Certified Professional Geologist and bear his/her seal. Items submitted in compliance with section 7(a)(1)(C), section 7(a)(1)(E)(iv), section 7(a)(1)(E)(vi) and section 7 (c) are exempt from certification by a Certified Professional Geologist when performed by the following:

- (A) an officer or employee of the United States government, state government, or local government while engaged in providing geological services for the officer's or employee's employers.
 - (B) a person engaged solely in geological research or instruction of geology.
 - (C) a professional engineer registered under IC 25-31 who applies geology to the practice of engineering.
- (3) An inventory of potential sources of contamination containing a complete list of existing facilities, sites, practices, and activities for both regulated and unregulated potential sources of contamination. The inventory of potential sources of contamination must be submitted in the following forms:
- (A) A narrative description of land use within the WHPA.
 - (B) A land use map with potential sources of contamination plotted, showing their locations relative to the WHPA boundaries.
 - (C) A table containing information describing the potential sources of contamination including the following:
 - (i) Facility identification number, cross-referenced to clause (B).
 - (ii) Facility name and location.
 - (iii) Site description.
 - (iv) Any environmental permits issued for the site, including number and agency issuing the permit.
 - (v) Types of contaminants at site.
 - (vi) Operating status of site.
- (4) A management plan that must include the following:
- (A) A plan to manage the sanitary setback area that includes the following:
 - (i) Measures for the management of the area, consistent with the requirements of 327 IAC 8-3.
 - (ii) Measures to prohibit the storage and mixing of chemicals, other than:
 - (AA) those used for drinking water treatment; or
 - (BB) pesticides that are regulated by the pesticide review board through IC 15-3-3.5 and IC 15-3-3.6.
 - (iii) Provisions to secure the wellhead to prevent unauthorized access.
 - (iv) Guidelines that employ best management practices for transportation routes within the sanitary setback area.
 - (B) A plan to manage the WHPA that addresses the following:
 - (i) Management or monitoring measures for all potential sources of contamination as identified in subdivision (3) to effectively protect the ground water and drinking water supply. The management or monitoring measures must consider the locations and type of potential sources of contamination and hydrogeologic characteristics of the WHPA.
 - (ii) Compliance of CPWSS production wells with state construction standards and permit requirements under 327 IAC 8-3 and 310 IAC 16.
 - (iii) Monitoring for contaminants associated with identified potential sources of contamination according to the department's standardized monitoring framework under 327 IAC 8-2.
 - (iv) Methods or procedures for maintaining and updating records concerning changes to potential sources of contamination within the WHPA.
 - (v) Identification of abandoned wells not in compliance with IC 25-39-4-6 and 310 IAC 16-10.
 - (vi) Use, application, storage, mixing, loading, transportation, and disposal of pesticides in accordance with IC 15-3-3.5, IC 15-3-3.6, and the rules and guidance thereunder, developed by the

pesticide review board and the state chemist.

(vii) Notification of property owners, mineral owners and leaseholders of record that they are located within a WHPA.

(viii) Provide owners and operators of identified potential sources of contamination access to a copy of the local WHPP.

(ix) The establishment of a public outreach program to educate the public and owners or operators of identified potential sources of contamination about the consequences of ground water contamination, and the methods available for preventing ground water contamination.

(x) The posting of wellhead protection signs along major thoroughfares at the perimeter of the WHPA.

(xi) Other management measures required to comply with this section.

(5) A contingency plan to provide safe drinking water in emergency conditions must include the following:

(A) Description of plan to train local responders.

(B) Description of emergency response to leaks, spills, or illegal discharges.

(C) A list of information to be provided to local responders, including the following:

(i) Location of WHPA boundaries.

(ii) CPWSS operators to contact during an emergency.

(iii) A twenty-four (24) hour telephone number for the following:

(AA) IDEM, office of emergency response.

(BB) State, local, and city/county police.

(CC) State, local, and city/county fire/hazmat team.

(DD) City or county disaster services agency.

(EE) Water supply owner, superintendent, and operator.

(FF) City or county hospital.

(D) Identification and description of potential alternate sources of water.

(E) Identification of procedures and description of methods to notify critical water users of an emergency.

(F) The posting of procedures to follow in an emergency and information on the location and availability of the complete contingency plan.

(Water Pollution Control Board; 327 IAC 8-4.1-8)

327 IAC 8-4.1-9 Phase II submittal requirements

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 9. To have Phase II of a WHPP approved by the department, a CPWSS must submit the following material within the time frame prescribed in section 15 of this rule:

(1) Phase II delineation must include the following:

(A) An updated Phase I submittal reflecting changes if any.

(B) A discussion describing how the updated WHPA compares with the previously delineated WHPA.

(2) Phase II potential sources of contamination inventory must include an update to the source inventory provided in the Phase I submittal.

(3) Phase II management plan must include the results of the implementation of Phase I management plan.

(4) Phase II contingency plan must include documentation of training given to local responders.
(Water Pollution Control Board; 327 IAC 8-4.1-9)

327 IAC 8-4.1-10 Department review of Phase I and Phase II submittal requirements

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 10. (a) The department shall review Phase I and Phase II submittals based on the following criteria:

(1) WHPA delineation including the following:

(A) The completeness and accuracy of the data used to determine the hydrogeologic conceptualization as required in section 7 of this rule.

(B) The information provided in the submittal demonstrates that the chosen delineation method properly accounts for site specific hydrogeology.

(2) Potential sources of contamination inventory including the following:

(A) The completeness of the specific data supplied regarding each facility, site, practice, and activity, including the following:

(i) The inventory, identification, and location of all potential sources of contamination according to the data requirements of section 8(3) of this rule.

(ii) Identification of all potential sources of contamination in the WHPA on a map that includes the boundaries of the time of travel.

(iii) Characterization of the potential sources of contamination as specified in section 8(3)(C) of this rule is sufficient to develop a management plan as prescribed by section 8(4)(A) and 8 (4)(B) of this rule.

(B) The department shall evaluate Phase II based on the completeness of the update to adequately characterize the status of all potential sources of contamination identified and inventoried under Phase I, and any new potential sources of contamination that have located within the WHPA.

(C) The department shall evaluate the updates made to the potential sources of contamination inventory every five (5) years, as required by section 9(2) of this rule, for completeness with respect to the status of all potential sources of contamination identified in the Phase I and Phase II submittals.

(3) Management plan including the following:

(A) The Phase I management plan will be considered effective when all management plans and submittal requirements of section 8(4)(A) and 8(4)(B) of this rule and subdivision (1) have been met.

The management plan must consider the following:

(i) Site-specific hydrogeology.

(ii) Land use.

(iii) Conditions of potential sources of contamination.

(B) The department will approve Phase II, results of implementation of Phase I, upon finding that the management plan has been implemented as proposed under section 8(4)(B) of this rule.

(b) Under Phase I, the department may require the use of a different delineation method. Under both Phase I and Phase II, the department may require submittal of additional data to support information provided as part of the WHPP.

(c) For a CPWSS using the fixed radius method to delineate a WHPA, the department may require the use of a different delineation method if the CPWSS fails to maintain the qualification for use of the fixed radius method as outlined in section 5(d) of this rule.
(Water Pollution Control Board; 327 IAC 8-4.1-10)

327 IAC 8-4.1-11 Tracking of potential sources of contamination inventory and management plan

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 11. (a) The department shall track Phase I accomplishments by mailing two (2) surveys to each CPWSS as follows:

- (1) The first survey shall be mailed two (2) years, and the second shall be mailed one (1) year, prior to the deadline for Phase I submittal for a large CPWSS.
- (2) The first survey shall be mailed two and one-half (2 ½) years, and the second survey shall be mailed one (1) year, prior to the deadline for Phase I submittal, for a medium CPWSS.
- (3) The first survey shall be mailed three (3) years, and the second survey shall be mailed one (1) year, prior to the deadline for Phase I submittal, for a small CPWSS.

(b) The department shall track Phase II progress by sending an additional survey, that includes an update of the potential sources of contamination inventory, to each CPWSS two (2) years before the Phase II requirements must be submitted to the department as follows:

- (1) The survey shall be mailed three (3) years after the department's approval of the Phase I submittal for a large CPWSS.
- (2) The survey shall be mailed five (5) years after the department's approval of the Phase I submittal for a medium CPWSS.
- (3) The survey shall be mailed eight (8) years after the department's approval of the Phase I submittal for a small CPWSS.

(c) Continued tracking of management plans will begin five (5) years after the department's approval of the Phase II submittal and will continue in five (5) year cycles as long as the CPWSS is in operation.

(d) Any CPWSS that has not applied for approval of the WHPP within the designated period set forth in section 15 of this rule will be considered in noncompliance.

(e) All surveys must be completed and submitted to the department within forty-five (45) days of receipt.

(Water Pollution Control Board; 327 IAC 8-4.1-11)

327 IAC 8-4.1-12 Submittal requirements for proposed new wells

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 12. (a) For a proposed well site in a department approved Phase I or Phase II WHPP, with the

proposed well included in the WHPA delineation, the CPWSS shall apply for a construction permit, as provided for in 327 IAC 8-3, and shall describe the proposed well site in relation to the approved WHPA.

(b) For a proposed well site in a department approved Phase I or Phase II WHPP, with the proposed well not included in the WHPA delineation, the CPWSS shall apply for a construction permit as provided for in 327 IAC 8-3, and shall submit new well site submittal requirements as described in section 13 of this rule.

(c) For a proposed well site in a wellfield not in a department approved Phase I or Phase II WHPP, the CPWSS must apply for a construction permit as provided for in 327 IAC 8-3, and shall submit new well site submittal requirements as described in section 13 of this rule.

(Water Pollution Control Board; 327 IAC 8-4.1-12)

327 IAC 8-4.1-13 New Well Site Submittal Requirements

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 13. (a) All CPWSSs subject to this rule must receive approval for a new well site and shall submit the following:

- (1) A United States Geological Survey seven and one-half (7.5) minute series topographic map illustrating the area surrounding the well and proposed well site.
 - (2) A detailed map, drawn to a scale between 1"= 400' and 1"= 1,000', showing the following:
 - (A) Proposed well site with ownership or easement boundaries.
 - (B) The location of the proposed well.
 - (C) The sanitary setback area.
 - (3) A WHPA delineated using the following:
 - (A) Fixed radius method, with a radius of three thousand (3,000) feet, regardless of the pumping capacity of the system.
 - (B) An analytical, semianalytical, or numerical model, executed by a qualified ground water scientist, using input parameters calculated from:
 - (i) regional data from published reports; or
 - (ii) site specific data.
 - (C) Any approved method described in section 5 of this rule.
 - (4) A potential sources of contamination inventory performed by methods outlined in section 8(3) of this rule.
 - (5) A summary of geologic and ground water quality information for the aquifer system utilized by a proposed well, where available.
 - (6) A schedule for the development of a Phase I WHPP.
- (b) Approval of a CPWSS proposed well site is dependent on the ability of each CPWSS to provide safe drinking water as determined by the department.

(c) To maintain well site approval status, the CPWSS must meet the following requirements:

- (1) Allow no new potential sources of contamination to locate within the sanitary setback area.

(2) The CPWSS is operated in such a manner that it will not violate any sanitary or health regulations or requirements.

(3) Maintenance of additional requirements specified by the CPWSS construction permit.

(Water Pollution Control Board; 327 IAC 8-4.1-13)

327 IAC 8-4.1-14 Well site denial criteria

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 14. The department may deny a well site if:

(1) A source of chemical or pathogenic contamination is found within the sanitary setback area that is so severe that it cannot be consistently treated or managed to a level considered safe by standards under 327 IAC 8-2; or

(2) a chemical or pathogenic contaminant reported in the ground water quality information submitted under section 13(b)(6) of this rule is so severe that it cannot be consistently treated or managed to a level considered safe by standards under 327 IAC 8-2.

(Water Pollution Control Board; 327 IAC 8-4.1-14)

327 IAC 8-4.1-15 Alternative approaches to WHPP

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 15. (a) The department may approve alternate approaches to section 8(4)(A) of this rule upon a showing that water from a well or wellfield providing ground water to a CPWSS exceeds the standard for conventional ground water treatment as set forth in 327 IAC 8-2.

(b) In reviewing the alternative management plan under this section, the department shall consider whether the proposed alternative management plan will result in the consistent provision of finished water in compliance with 327 IAC 8-2.

(Water Pollution Control Board; 327 IAC 8-4.1-15)

327 IAC 8-4.1-16 Community public water supply systems submittal deadlines; department approval deadlines

Authority: IC 13-18-3; IC 13-14-8; IC 13-18-17-6

Affected: IC 13-11; IC 13-13; IC 13-18

Sec. 16. (a) Each CPWSS must submit all materials required by this rule as follows: (See Table 1 in subsection (c).)

(1) Phase I submittals are as follows:

(A) All materials must be submitted within three (3) years for large CPWSS.

(B) All materials must be submitted within four (4) years for medium CPWSS.

(C) All materials must be submitted within five (5) years for small CPWSS.

(2) Phase II submittals are as follows:

(A) All materials must be submitted within five (5) years after department approval of Phase I material for large CPWSS.

(B) All materials must be submitted within seven (7) years after department approval of Phase I material for medium CPWSS.

(C) All materials must be submitted within ten (10) years after department approval of Phase I material for small CPWSS.

(b) The department will approve or disapprove the materials submitted within one hundred eighty (180) days after submission.

(c) The wellhead protection overview shall be as follows:

Table 1 - Wellhead Protection Overview

	PHASE I		PHASE II	
Public Water Supply System Size (population served)	Submittal Time (years)	Submittal Requirements	Submittal Time from Phase I Approval (years)	Submittal and Update Requirements
Large >50,000	3	<ol style="list-style-type: none"> Names, roles, and affiliation of the local planning team members. WHPA delineation, including: <ol style="list-style-type: none"> Summary of geologic and hydrologic condition of the WHPA. Model input data. Justification of model choice. Potential sources of contamination inventory. Management strategy with schedule for implementation. Contingency plan. Description of public participation. Description of public education program. 	5	<ol style="list-style-type: none"> Comprehensive WHPP. Updated schedule of implementation. Updated WHPA, considering new data if any. Updated potential sources of contamination inventory. Report of any problems or concerns regarding WHPP. Contingency plan revisions (if needed). Documentation to confirm: <ol style="list-style-type: none"> Sanitary Setback Area meets requirements. Abandoned wells are identified. Wellhead is secured from unauthorized access. All potential sources of contamination within the WHPA are managed. Signs are posted at WHPA perimeter. Public education is ongoing. Any new ground water contamination within the WHPA is reported.

Medium 3,301 to 50,000	4		7	
Small ≤3,300	5		10	

(Water Pollution Control Board; 327 IAC 8-4.1-16)

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